Integrating and Strengthening the European Research Area

ERANET

Coordination Action

ASTRONET

Coordinating Strategic Planning for European Astronomy

Contract n° 026075

Starting date : 1 September 2005 **Duration : 4 years**

Deliverable number	**D6**
Title	**Report on the Management of European Astronomy**
Work package	**WP1.1**
Due date	**01/09/06**
Submission date	
Organisation name(s) of lead contractor for this deliverable	**INAF – Istituto Nazionale di Astrofisica**
Prepared by	**A. Fontana, C. Perna**
Approved by	**Astronet Board**
Released by	
Nature	
Revision	**V3.1.4**

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	**X**
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

ASTRONET
www.astronet-eu.org

Coordinating Strategic Planning for European Astronomy

REPORT ON THE MANAGEMENT OF EUROPEAN ASTRONOMY

INAF
ISTITUTO NAZIONALE DI ASTROFISICA
NATIONAL INSTITUTE FOR ASTROPHYSICS

Printed in Rome, 13 June 2007

Viale del Parco Mellini, 84
I - 00136 Roma
ITALY

Report on the Management of European Astronomy

Adriano Fontana & Corrado Perna
(*INAF, I*)

Co-Authors:

Fabienne Casoli & Jean-Marie Hameury
(*INSU, F*)

Franz-Josef Zickgraf
(*PT-DESY, D*)

Jesus Gallego & Xavier Barcons
(*MEC, ES*)

Marieke van Duin & Frank Molster
(*NWO, NL*)

Michelle Cooper
(*PPARC, UK*)

Content

Surveying European Astronomy

Towards a coordination of astrophysical research across Europe: an analysis of the management of the main astrophysics research institutions

Co-operation has been the key to the successes of European astronomy in the past decades. Ground and space-based facilities have been conceived, developed and managed by European organisations like ESA and ESO or by collaborative efforts among several European countries, making European astronomers leaders in the field. Co-operation will be even more important in the near future, since the new generation of infrastructures required to address the major scientific challenges are feasible only at the European or global level.

The goal of ASTRONET is to pave the way to a permanent and structured co-ordination among the key European players in this field, i.e. the national and transnational research funding agencies and international organisations.

To achieve this goal, ASTRONET will establish a comprehensive, consensus-based Science Vision and Infrastructure Roadmap, which will allow a better coordination among all participating countries for developing European astronomy at all wavelengths, on the ground and in space.
In parallel, ASTRONET will establish an exchange of information and co-ordination of best practices between agencies and initiate joint research programme, transforming European astronomy into a true European Research Area.

To build such an ambitious permanent coordination framework, a deep knowledge of the management of astronomy in the European countries is needed. The present report provides an analysis of the organisation of the astronomical research systems in the main participating European countries. For each country, a description of the main agencies and research institutes are presented, together with their managing rules, quantitative research data and financial resources involved.

The information has been assembled with a close co-operation among the agencies involved in ASTRONET, which are responsible for the content of their relevant country.

Chapter 1

The European Scenario

In most of the European countries research is traditionally carried out by public bodies that can generally be divided into the following categories:

- Funding agencies
- Performing bodies
- Mixed bodies (both funding and performing)

In the UK and in the Netherlands research in both space- and ground-based astronomy is almost entirely performed in the universities, apart from few specialized institutes. Funding and strategic priorities are planned and pursued through funding agencies (PPARC and NWO for the UK and the Netherlands, respectively). Priorities and strategic plans are defined by the contributions of scientists and experts from the universities. In the UK, PPARC also provides for the participation to international organisations like ESA and ESO.

In France, Germany, Italy and Spain, the systems are more complex. Besides universities, scientists working in research institutes provide a strong contribution to astrophysical research. The main research institutes are CNRS/INSU in France, MPG in Germany, INAF in Italy and CSIC in Spain; although, smaller independent research institutes exist. Here, astronomers typically have a low involvement in educational and teaching activities, although they contribute to the training of younger scientists.

Funding is provided through several channels. A fraction is directly managed by research institutes; while another fraction is provided by the government through a nation-wide competition, often open to all scientific disciplines. This is done either by specific agencies (like ANR for France and DFG and PT-DESY for Germany) or directly by the relevant ministers, as in Italy and Spain.

In addition, a strong contribution to astronomy is provided by space agencies (CNES for France, ASI for Italy, DLR for Germany, INTA for Spain) which have an autonomous role in planning and funding researches, both in universities and in research institutes, and participating in ESA programs.

With such a large number of participants combined with the independent planning and funding capabilities of ESA and ESO, it is not surprising that the decision-making process is often complex and non-linear at the European level, and it is sometimes felt to be too inefficient.

In addition, astrophysics is very interdisciplinary in nature, overlapping with many other scientific disciplines, such as fundamental physics, biology or earth sciences. As a result, the way these boundaries are defined is difficult to establish, and it varies from country to country and from agency to agency.

The goal of this document, and of ASTRONET, is to provide a comprehensive view of these management systems, focusing on the European countries that launched the ASTRONET initiative.

We provide in this chapter a global overview of all these systems. In the following chapters, we provide a more detailed description by each country. Before going into the descriptions, three important cautionary remarks need to be discussed.

First, the present report describes only the major European countries involved in ASTRONET: France, Germany, Italy, the Netherlands, Spain and the United Kingdom. This is not surprising, since these countries have promoted the ASTRONET initiative and have been, therefore, the most prompt in providing the wealth of information requested to compile this report. However, ASTRONET has initiated from its earliest phases measures to include as many European countries as possible. As a result, several European countries have entered or are considering joining ASTRONET over the recent months. As this process develops, the opportunity or necessity of a second version of this report will be assessed, to provide a more comprehensive view of the European scenario.

In addition, it must be kept in mind that the organisation and the managing rules of these large countries are often subject to significant changes. Over the last 18 months, for instance, a new agency for research funding, **ANR**, has started its operations in France, a new funding scheme for large infrastructures, **FIRST**, has been announced in Italy, and the Particle Physics and Astronomy Research Council (**PPARC**) in the UK has been merged with other Research Councils to form the Science & Technology Facilities Council. This report provides a description of the systems as of December 2006; as such, it does not describe the new Science & Technology Facilities Council, nor other recently announced changes in other countries.

Finally, a considerable effort has been devoted to the collection of quantitative data about the financial and human resources dedicated to astronomy in each

country. Despite this effort, the data acquired are still incomplete and inhomogeneous. One of the major reasons is the fragmentation and complexity of the European organisation in astronomy, and research in general. In many countries, researches are carried on in many independent institutes, most notably universities, and statistics about personnel and funding have not been compiled recently. Even when available, these statistics refer to different years and do not provide a view of the average investments over the last years, as would be more appropriate. In addition, accounting and budget systems are also much different and difficult to compare in a self-consistent way. Finally, the very definition of astronomy, and its splitting into sub-areas, is considerably different from country to country. As a result, some of the numbers that we provide are subject to uncertainties, and comparisons between different countries should be made with caution.

1.1. France

The major entities involved in astrophysical researches in France are the **universities** and **CNRS** - *Centre National de la Recherche Scientifique* (National Center for Scientific Research).

A typical feature of the French organisation is that astronomical researches are mainly performed within laboratories called **UMR** - *Unité Mixte de Recherche* (Joint Research Units) that are joint ventures between public research bodies and universities. Throughout France, there are 40 UMRs involved in astrophysics and astroparticle researches.

Another major funding agency is **CNES** - *Centre National d'Etudes Spatiales* (National Centre of Space Studies) that conceives and executes space programs, often in collaboration with ESA and other international partners, and supports the related scientific research and exploitation of space data.

All of these public bodies act under the supervising authority of the Ministry of Education and Research.

Main Scientific Institutions

CNRS is the largest French research institution, organized into 6 thematic departments. Research in astrophysics and astroparticle physics is performed within the MPPU department - M*athématiques, Physique, Planète et Univers* (Mathematics, Physics, Earth Sciences, and Universe).

Within CNRS, the national institute named **INSU** - *Institut National des Sciences de l'Univers* (National Institute for Earth Sciences and Astronomy) is in charge of defining the national strategic programs in astronomy and earth sciences research and providing resources for very large research infrastructures. INSU represents France in all international organisations that require a national membership, except ESO and ESA.

Universities are the other major players in astrophysical research. In addition to teaching duties, they support the operations of the UMR (Joint Research Units).

There are 2 astronomical observatories with a status of legal entity close to that of universities: the **Observatoire de Paris** and the **Observatoire de la Côte d'Azur**. Other observatories are groups in UMR with some technical and administrative staff or are national observation stations.

CNES is in charge of defining and implementing the space policy of France. A pluriannual State-CNES contract (currently 2005-2010) was signed between CNES, the Ministry for Higher Education and Research, the Ministry of Defence and the delegate Ministry of Budget. The contract defines the strategic vision of CNES, provides the programs priorities at short, medium and long-term and guaranties the resources allocated.

For the scientific program, CNES has established several advisory committees for: astronomy, Solar System, SHM (Sun, Heliosphere, Magnetosphere), and fundamental physics. The members of these committees are chosen by CNES. Space projects, themselves, are chosen by the Board after recommendations of the *CPS - Comité des Programmes Scientifiques*.

Other Scientific Institutions

Other important national institutions that are involved in the astronomy domain are:

IN2P3 - *Institut National de Physique Nucléaire et de Physique des Particules* (National Institute for Nuclear and Particle Physics) which performs the same kind of activities as INSU in the fields of nuclear and particle physics researches, including astroparticle physics and cosmology.

CEA - *Commissariat à l'Energie Atomique* (Commissariat for Atomic Energy) which performs fundamental research in the physical sciences, including astrophysics.

Funding

The funds for the French research system are mainly provided by the Ministry of Research that allocates funds to the national institutes, in particular to INSU and IN2P3 through CNRS. In astronomy, INSU is the funding agency for ground-based infrastructures and databases, including partnerships to international facilities such as IRAM, CFHT and THEMIS. IN2P3 is the funding agency responsible for astroparticle infrastructures like ANTARES, HESS and VIRGO.

INSU performs a call for proposals, based on the thematic priorities of the national astronomy plan, for R&D projects and for instrumentation.

In 2005, a new funding agency, the **ANR** - *Agence Nationale de la Recherche* (National Research Agency) has been founded. This agency launches several calls for research proposals once a year. About one third of the budget is devoted to un-targeted programs and this is the main call for which astronomy can apply. ANR funds equipment and non-permanent positions for up to 4 years (Ph.D. students, post-docs, technicians and engineers) but does not fund infrastructure nor permanent positions.

The French member at the ESO Council is appointed at the ministry level, while its funding comes through the Ministry of Foreign Affairs.
The ESA contribution is funded through CNES.

CNES funds R&D, instrumentation, databases and equipment for scientific space missions. It supports scientific analysis of space data and it also funds non-permanent personnel (engineers, technicians, post-doc and Ph.D. thesis).

Personnel

Research staff positions in CNRS and universities are divided into five different levels.

The recruitment of CNRS researchers is performed during a national competition that takes place in the spring. Candidates are selected by a committee composed of two-thirds of the members elected by researchers and one-third of the members designated and nominated by the Director General of CNRS.

University Professors are recruited on a local basis by a thematic committee called CSE - *Commission de Spécialistes d'Etablissement* which proposes a ranked list of names to the university boards.

Astronomers are employed by universities and have both a teaching and functional duties. They are selected by a committee named CNAP - *Conseil Nationale des Astronomes et Physiciens* (National Council of Astronomers and Physicists) that organizes a nation-wide competition.

The Numbers in French Astrophysics (2005)

Engineering Personnel

Body	Gender	Staff	Non Permanent positions
CNRS	Male	245	n/a
	Female	69	n/a
	Total	**314**	45
Universities	Male	121	n/a
	Female	39	n/a
	Total	**160**	210
Astronomers	Male	183	
	Female	54	
	Total	**237**	
CEA	Male	34	n/a
	Female	5	n/a
	Total	**39**	n/a

Funding

Body	Salaries (Researchers)	Salaries (engineers &technicians)	Running Costs	Infrastructures	Research Grants
Ministry	32	22		5	
ANR					6
CNES		18	n/a	42[1]	
INSU/CNRS	26	33	5	9	3

International Memberships

Organisation	Appointing Institution	Allocated Budget (M€)
ESA	CNES	61[2]
ESO	Ministry of Research Ministry of Foreign Affairs	17

n/a: Not available
[1] Includes ESA payloads.
[2] Mandatory program.

1.2 Germany

The federal nature of the German system implies the division of roles in education and research between the federal and the *Länder* (federal states) governments. The latter has the sovereignty for culture, which includes education and science. Universities are, thus, within the sovereignty of the Länder, which is responsible for the core funding and the human resources of the universities. In addition, universities also have a share in research funding. The federal government is responsible for research that is of national interest or in strategic fields. It applies, in conjunction with the Länder, a combination of targeted project funding and institutional funding of large research organisations.

Main Scientific Institutions

There are 19 **universities** with departments active in astronomy and astrophysics, including a private one, the International University Bremen (IUB).

The *Max-Planck Gesellschaft* (Max Planck Society for the Advancement of Science, **MPG**) is an independent, non-profit research organisation. There are eight Max-Planck Institutes active in astronomy and astrophysics. The **MPG** has its own budget, which is directly provided by the BMBF (*Bundesministerium für Bildung und Forschung,* Federal Ministry of Education and Research) and the Länder to the main MPG society, with a 50%-50% financing shares, and the institutes compete for the funding. Funds are allocated directly to the directors of the Max-Planck Instituts who are then responsible for their use

The Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz e.V. (Leibniz Foundation, **WGL**) is a scientific organisation comprised of 84 non-university research institutes and service facilities. Among these are two astronomy and astrophysics devoted institutes, the Astrophysikalisches Institut Potsdam (AIP) and Kiepenheuer-Institut für Sonnenphysik (KIS).

The *Deutsches Zentrum für Luft- und Raumfahrt*, (German Aerospace Center, **DLR**) is Germany's national research centre for aeronautics and space. As Germany's space agency, the DLR acts on behalf of the German federal government for the forward planning and implementation of the German space programme as well as international representation of Germany's interests. It performs its activities on an independent strategic planning by a programme commission for space science with representatives also from science. There are programme boards for extraterrestrial science, earth observation, as well as a referee board for the evaluation of project proposals.

The *Helmholtz-Gemeinschaft Deutscher Forschungszentren* (HGF) (Helmholtz Association) is a community of 15 scientific-technical and biological-medical research centres. In the field of planetary science, there is one Helmholtz Centre, the Institut für Planetenforschung, which is part of Deutsches Zentrum für Luft- und Raumfahrt (DLR), located in Berlin-Adlershof. In the field of astroparticle physics, there are research groups at two Helmholtz

Centres, namely at the Deutsches Elektronen-Synchrotron DESY in Hamburg and at the Forschungszentrum Karlsruhe (FZK).

Funding

As the largest single research funding agency, the BMBF supports research by funding basic research and the respective organisations, key technologies and prevention research jointly with the Länder. Due to constitutional constraints, project funding by the BMBF has the pre-condition of a superior federal interest which justifies federal funding. Typically, in the field of astronomy this is the case for large international infrastructures with a major financial contribution by the BMBF.

In the institutional funding scheme MPG and WGL are jointly funded by the federal government and the Länder with shares of 50% and 50%, and HGF with a 90:10 ratio, respectively.

BMBF's support is focused on large-scale research, of supra-regional, international or fundamental significance. The focus of BMBF support is on physics, astrophysics and astronomy as well as on selected research topics requiring special large-scale equipment including astrophysics and astroparticle physics. The co-action of research groups and national or international large facilities is supported through the funding scheme called "Projektförderung". Funding is available primarily for universities in order to enable research by university groups using large facilities. Research institutes like Max Planck Institutes and Helmholtz Centres are eligible for this funding scheme only with strong restrictions.
BMBF issues strategic guidelines for the usage of these funds (e.g. support for VLT instruments). For the funding period 2005-2008 it allocated 3.5 M€/year for astroparticle physics and 3.0 M€/year for astrophysics. BMBF funds are granted as three-year contracts. Calls are open every three years.

PT-DESY (*Projektträger DESY*) acts on behalf of BMBF and is authorised by the BMBF to implement a call dedicated to the funding of astrophysical and astroparticle research programs related to ground-based large facilities, which forms one joint funding programme section.

The **DFG** - *Deutsche Forschungsgemeinschaft* (German Research Foundation) is the central, self-governing research-funding organisation that promotes research at universities and other research institutions in Germany, serving all branches of science and the humanities. The federal government and the Länder jointly finance the budget of the DFG with shares of 58% and 42%, respectively. Funds are dedicated to individual or coordinated research programs, but not to infrastructures. The main evaluation criterion is scientific excellence, with no a-priori allocation planning to the different disciplines or strategic guidelines. DFG issues a wide variety of funds, ranging from small programs for single scientists to large programs among several coordinated institutions.

DLR funds science projects at Max-Planck institutes, universities, WGL institutes and industrial activities with a budget of about 30 M€ per year presently. Funding includes the scientific usage of data from space missions, the development and construction of components, in particular, scientific instruments, and even of entire satellites.

The **Länder** funds basic research at universities, and on specific scientific projects. They also co-fund research institutions together with the federal government.

Personnel

Research staff positions in universities and research institutes include Full Professors/Research Managers, Associate Professors, Researchers, and temporary positions partly financed by third party funds. Contrary to regular professorships, Junior Professors hold non-permanent positions, limited to 6 years, which under certain conditions can be tenure-track. universities and research institutes offer post-doc positions with and without direct links to specific projects. Ph.D. degrees are granted by universities, which select students through a competitive evaluation procedure.

The Numbers in German Astrophysics

	Body	Gender	Staff	Non-permanent Positions
Personnel	**Universities**	Male	n/a	n/a
		Female	n/a	n/a
		Total	**141**	**329** (incl.246 Ph.D.)
	Other Research Institutions	Male	n/a	n/a
		Female	n/a	n/a
		Total	**191**	**422** (incl. 163 Ph.D.)

	Body	Total funds in M€/year (2000)[1]
Funding	**DFG**	9
	BMBF (national)	11
	Länder	58
	DLR (national)	16
	MPG (institutional)	60

	Organisation	Appointing Institution	Membership Budget
International Memberships	**ESA**	BMWi[2] (delegated to DLR)	50 (yr:2000)
	ESO	BMBF	22 (yr:2000)

n/a: Not available

[1] Data refer to year 2000; source: DFG Denkschrift "Status und Perspektiven der Astronomie in Deutschland 2003-2016", 2003

[2] Before 2005: BMBF

1.3 Italy

The researches in astrophysics in Italy are mainly performed by **INAF** - *Istituto Nazionale di Astrofisica* (National Institute for Astrophysics), a national research institute and by **university departments**. Another major funding agency is **ASI** - *Agenzia Spaziale Italiana* (Italian Space Agency). All these public bodies act under the supervising authority of MUR - *Ministero dell'Università e della Ricerca* (Ministry of University and Research) which also provides for their running costs

Main Scientific Institutions

INAF is made up of 19 institutes, namely 12 astronomical observatories and 7 institutes formerly belonging to CNR - *Consiglio Nazionale delle Ricerche* (National Research Council) located in 12 different cities. It manages the participation of ground-based facilities like TNG, LBT and radio telescopes and promotes researches in all astrophysical fields. Its long-term strategy is defined in the Long-Term Plan, drafted by the INAF Science Council.

There are 4 astronomy/astrophysics **university departments** in Italy, but astronomical research is also carried on in 30 physics departments. Many universities offer a degree of some level in astronomy or astrophysics as well as a Ph.D. course in astronomy. Part of these initiatives are directly funded by INAF.

A very small number of astronomers perform research activities within ASI, which also includes the management of the ASI Science Data Center.

Other public bodies performing related researches are **INFN** - *Istituto Nazionale di Fisica Nucleare* (National Institute for Nuclear Physics) for astro-particle physics and **INGV** - *Istituto Nazionale di Geofisica e Vulcanologia* (National Institute for Geophysics and Volcanology) for space weather.

Funding

The main ground-based infrastructures are funded by INAF and by targeted funds provided by the Minister.

ASI directly funds the participation to major projects for the development and exploitation of space-based instruments.

The Ministry of Research allocates further funding for research projects, through nation-wide competition calls with no pre-defined allocation for the different disciplines. Both, researches at INAF and at the universities, can typically participate for funding requests.
ASI funds research and exploitation of science data through targeted contracts.

The Italian membership at ESO is appointed and funded by *Ministero degli Affari Esteri* (Ministry of the Foreign Affairs).

The ESA membership is appointed and funded by ASI

Personnel

Research staff positions in universities and research institutes have three different levels (Full Professor/Research Managers, Associate Professor/First Researcher, Researcher).

The total number of university professors that are active in astronomy are about 380.
Within INAF, the total number of involved astronomers are about 570 (staff) and 320 (non-permanent positions).

Recruitment for permanent positions are made independently of INAF and of each university. Both INAF and the universities are free to define the number and level of positions, given some budget constraints. University selections are local.

The Numbers in Italian Astrophysics (2005)

Personnel

Body	Gender	Staff	Non-permanent Positions
INAF	Male	445	209
	Female	126	107
	Total	**571**	316
Universities	Male	164	87
	Female	21	45[1]
	Total	**185**	**132**[1]

Funding (M€)

Body	Salaries (Researchers)	Running Costs	Infrastructures	Research Grants (2005)
MUR			2.2	2.6
ASI	n/a	n/a	32[2]	
INAF	77.5		6.4	4.5
Universities	11[3]	n/a	n/a	n/a

International Memberships

Organisation	Appointing Institution	Membership Budget
ESA	ASI	30
ESO	Ministry of Foreign Affairs	16.5

n/a: Not available
[1] Number estimated from the list of researchers in Universities and other institutes associated to INAF
[2] Grants to astrophysical researches. Do not include ESA payloads
[3] Number estimated from average salaries.

1.4 The Netherlands

Astronomical research in the Netherlands is undertaken within **universities** and in two astronomical institutes, **ASTRON** and **SRON**. The two latter are run under the responsibility of **NWO** - *Nederlandse Organisatie voor Wetenschappelijk Onderzoek* (Netherlands Organisation for Scientific Research) a semi-governmental organization that functions as a national research council and provides a major part of the Dutch funds in astronomy.

In addition, the **NCA** (The Netherlands Committee for Astronomy) acts as a top-level coordinator for Dutch astronomy. This discussion forum coordinates research activities and policy-making decisions among the astronomical institutes in the Netherlands, although it has no funding resources. NCA represents the Netherlands in the International Astronomical Union (IAU)

Main Scientific Institutions

A major fraction of astrophysics research in the Netherlands is carried out in **university departments**. The ones involved are:

- University of Amsterdam (UvA) – Astronomical Institute 'Anton Pannekoek'
- University of Groningen (RuG) – Kapteyn Astronomical Institute
- University of Leiden (UL) – Leiden Observatory
- University of Nijmegen (RU) – Department of Astrophysics
- University of Utrecht (UU) – Astronomical Institute Utrecht

Together, these comprise **NOVA**, the Netherlands Research School for Astronomy. In 1998, NOVA was identified by the Dutch government as a national focus area for world-class scientific research and received a grant to carry out a 5-year innovative program which has been extended for another 5 year in 2003. NOVA supports the astronomical research (observational and theoretical), and also has a coordinating role in instrument development for astronomical observatories (ground-based and in space).

All graduate astronomy education in the Netherlands is concentrated in NOVA.

NWO was set up by an act of parliament as an independent organization, and relies for its funding almost entirely on **OCW** - *Ministerie van Onderwijs, Cultuur en Wetenschap* (Ministry of Education, Culture and Science). NWO designs the national strategy and provides the funding programs.

Science policy within NWO is determined through its discipline oriented research councils. Astronomy resides under the Council of Physical Sciences (GBE, mathematics, computer sciences, and astronomy).

ASTRON is a NWO institute with the task to exploit the Westerbork radio telescopes and to develop new technologies and instruments for ground-based telescopes. It also hosts the Joint Institute for Very Long Baseline Interferometry in Europe (JIVE), the global project office of the Square Kilometer Array (SKA). Its Board of Governors is responsible for setting global policy at the institute. Its membership reflects the institutional composition of the astronomical community in the country, augmented by several external experts in the areas of importance to ASTRON.

SRON (The Netherlands Institute for Space Research) is another NWO institute , which acts as the national centre of expertise for space research in the Netherlands. Its mission is to design and develop world-class innovative space instruments for astrophysical and earth-oriented research and to analyse the data provided by these instruments. In addition, SRON promotes, coordinates and supports Dutch activities in space research; and, advises the Dutch government on the participation in international space research programs, in particular those of ESA.

NCA acts as a top-level coordinator for Dutch astronomy. All university astronomical institutes, NOVA, and the NWO institutes ASTRON and SRON are represented at the NCA by their directors. In addition, the astronomical member on the NWO-Physical Sciences Council and the Dutch astronomical members of the ESO Council, and Boards of ING and JCMT are represented. Although the main funding partners for astronomy in the Netherlands are member of NCA, NCA in itself has no funding resources.

Others Scientific Institutions

KNAW - *Koninklijke Nederlandse Akademie van Wetenschappen* (the Royal Netherlands Academy) was founded in 1808 by King Louis I Napoleon Bonaparte to ensure the quality of scientific research in the Netherlands, offering solicited and unsolicited advice on scientific matters. KNAW has established an advisory council for Physics and Astronomy and an "ESO contact committee", with the aim of coordinating and preparing the national policy matters and scientific issues concerning ESO.

Funding

Astronomical research in the Netherlands is funded in three ways: via basic university funding, via the Ministry of OCW (e.g. for the research school NOVA and the contributions to ESO and ESA) and via NWO (mainly via grants). NWO has several funding programmes, e.g. the Open Competition, which is a non-thematic project-based funding programme, and a more complex granting scheme, called "Veni, Vidi, Vici", that ensures funding to different classes of researchers, from young postdoctoral researchers to senior staff, and for projects of different complexities. Applications are typically submitted through a peer review process, using a combination of external referees and national committees.

Personnel

Most Dutch astronomers have staff positions at university Departments of Physics and Astronomy.
In 2005, 84 professional astronomers (5% female) had permanent staff positions in Dutch universities, with 42 post-docs and tenure-tracks and 98 Ph.D. students. The combined scientific staff of SRON and ASTRON consists of 61 scientists and 18 post-docs and tenure-tracks

The Numbers in Dutch Astrophysics

	Body	Gender	Staff	Non-permanent Positions
Personnel	**Universities**	Male	84	140
		Female	5	40
		Total	89	180
	SRON/ASTRON	Male	58	21
		Female	3	4
		Total	61	25

	Body	Salaries (Researchers)	Running Costs	Infrastructures	Research Grants
Funding	**OCW**				4.2
	NWO	n/a	n/a	2.8	9.1
	Universities	n/a	n/a		n/a

	Organisation	Appointing Institution	Membership Budget
International Memberships	**ESA**	OCW & EZ	n/a
	ESO	OCW	n/a

n/a: Not available

1.5 Spain

In Spain, the research is performed in both universities and research institutes, while the funding and planning activities are managed by MEC (Ministry of Research), through regular calls defined in the framework of a 4 years national plan.
The Ministry also funds the membership and appoints deputies at ESO and also funds the ESA mandatory program. Spanish deputies at ESA Councils are appointed by the Ministry of Industry and Trade.

Main Scientific Institutions

Universities provide a significant contribution to Spain's research. University departments, where research is conducted along with teaching, host several astronomy groups. About 35 universities host research groups in astrophysics.

The largest Spanish research public body is **CSIC -** *Consejo Superior de Investigaciones Cientificas* (Superior Council for Scientific Research) that plays an active role in the science policy through many centres across Spain. CSIC covers all fields of knowledge, from basic research to advanced technological developments.

Four CSIC institutes are involved in astrophysics and belong to the Physical and Technological Sciences Area (*Área de Ciencias y Tecnologia Físicas*). The largest being the Instituto de Astrofísica de Andalucía which manages the Observatory of Calar Alto and the Sierra Nevada Observatory.

The **Instituto de Astrofísica de Canarias** (**IAC**) is the largest astronomy centre. It comprises the *Instituto de Astrofísica*, which forms the main headquarters in La Laguna (Tenerife), the *Observatorio del Roque de los Muchachos* (**ORM**, La Palma), the *Observatorio del Teide, in Izaña* (**OT**, Tenerife) and the *Common Centre for Astrophysics on La Palma* (**CALP**). Jointly, these form the so-called European Northern Observatory. The Spanish membership at consortium involves the MEC, the CSIC, the University of Laguna and the regional government of Canary Islands.

The **Observatorio Astronómico Nacional** (**OAN** – National Astronomical Observatory) is part of the IGN - *Instituto Geográfico Nacional* (National Geographic Institute) that belongs to the Ministry of Public Works (Ministerio de Fomento). OAN manages several astronomical facilities including the Spanish partnership in IRAM.

The space activities are mainly performed by **INTA**, the National Institute for Aerospace Technology, which belongs to the Ministry of Defence. It plays a role in astrophysics by providing technical assistance to the projects.

Funding

The main national funding resource is the Ministry of Education and Science. It funds research teams' projects by calls on the base of a 4-yearly National Plan for Research, Development and Innovation, with a total budget, for 2005, of 300 million euros. In 2000, it had created the Astronomy & Astrophysics Programme whose fundamental aim is to support basic research in astronomy and astrophysics and to design, develop and exploit astronomical instrumentation. The selection procedure is made by two steps: first a scientific, blind evaluation is done by the **ANEP** - *Agencia Nacional de Evaluación de Proyectos* (National Agency for Project Evaluation), an independent agency appointed by MEC, followed by a panel that defines the priorities according to the national plan.
This is complemented by the National Space Programme, where an important ingredient is the development of scientific payloads for astronomy and Solar System missions and their scientific exploitation.

Infrastructures, and particularly what in these days are called "singular scientific infrastructures" (which for astronomy means telescopes or similar), are funded through independent channels and budgeted separately. An "Advisory Committee on Singular Infrastructures" proposes, evaluates and oversees these at the national level.

A minor role in funding is played by other ministries and also by the regional governments.

The ESA membership is provided by the Ministry of Industry, Trade and Tourism. Spain has recently become a member of ESO and the membership is funded by the Ministry of Education and Science.

Personnel

The number of Spanish astrophysicists is relatively small, with 460 researchers in 2002, that corresponds to 11.8 per million of inhabitants.

Scientific positions in public bodies come from CSIC positions or autonomous government positions. In the case of CSIC researches, positions are subdivided in three levels. The number of new entry levels is decided by the Council of Ministers. Then, an ad hoc committee performs the selection.

Within universities, a large fragmentation exists: only two university groups have more than 25 researchers, four groups have between 20 and 25 researchers, twelve groups have more than 5 and less than 10 researchers. Finally, six groups have less than 5 researchers.

The Numbers in Spanish Astrophysics

	Body	Gender	Staff	Non-permanent Positions
Personnel	**Universities**	Male	n/a	n/a
		Female	n/a	n/a
		Total	65	n/a
	CSIC	Male	n/a	n/a
		Female	n/a	n/a
		Total	38	n/a
	Others	Male	n/a	n/a
		Female	n/a	n/a
		Total	126[1]	n/a
	TOTAL	**Total**	229	231

	Body	Salaries	Running Costs	Infrastructures	Research Grants
Funding	**MEC**		n/a	n/a	3.5
	Others	n/a	n/a	n/a	n/a

	Organisation	Appointing Institution	Membership Budget
International Memberships	**ESA**	Ministerio de Industria, Turismo y Comercio	122.6[2]
	ESO	MEC	10

n/a: Not available
[1] Number obtain by: global national (460) – (CSIC + Universities)
[2] Country ESA membership for all kind of activities, not only astrophysics

1.6 United Kingdom

With respect to other systems, the UK organisation is extremely simplified. A single national agency, **PPARC** (*Particle Physics and Astronomy Research Council*), is in charge of planning and funding research, education and public understanding in four broad areas of science - particle physics, astronomy, cosmology and space science.
PPARC is also in charge of representing the UK membership in ESO and ESA councils.
In turn, most astronomical research in the UK is undertaken within **universities**, largely relying on the resources made available by PPARC.

Main Scientific Institutions

Most of the **UK universities** have Departments of Physics and Astronomy within their Science faculties. These departments undertake research as well as teaching as part of their portfolio of activities. A survey conducted in 2003 indicated that there were 47 research organisations with PPARC research grants as of 1 November 2003.

PPARC is the UK's strategic science investment agency and is, therefore, responsible for the direction, co-ordination and funding of the UK research in particle physics, astronomy, cosmology and space science. PPARC's key objectives, and its broad, long-term strategies for achieving them, are enshrined in its Strategic Plan, which is revised every few years on the basis of recommendations from its advisory bodies and the PPARC Executive. These long-term strategies are translated into more immediate targets in the PPARC Operating Plan, which is produced each year.

Others Scientific Institutions

The Royal Society is a leading independent scientific academy of the UK dedicated to promoting excellence in science, and plays an influential role in supporting the developments in science, engineering and technology in a wide range of ways.

The Royal Astronomical Society is a leading professional body for the UK astronomy and astrophysics, geophysics, solar and solar-terrestrial physics, and planetary sciences. The RAS organises scientific meetings and publishes research and review journals. The Society also awards grants and prizes, supports educational activities and lobbies government.

Funding

PPARC receives an annual budget from OSI (*Office of Science and Innovation*) and, in turn, provides research grants and studentships to scientists in British universities, gives researchers access to world-class UK-operated and international partnership facilities and funds the UK membership of international bodies such as the European Organisation for Nuclear Research, (CERN), the European Space Agency (ESA) and the European Southern

Observatory (ESO). The majority of PPARC's budget (over 90% in 2002/03) goes to funding research in astronomy and particle physics.
Infrastructure funding of large astronomy facilities and long-term projects are assigned following the advice provided by PPARC's Science Committee, a body of senior astronomers and particle physicists from the UK universities. Funding to smaller projects are assigned following a peer evaluation process.
PPARC also contributes funds for the UK telescopes located overseas on La Palma, Hawaii, Australia and in Chile, the UK Astronomy Technology Centre at the Royal Observatory, Edinburgh and the MERLIN/VLBI National Facility.

HEFCE (*High Educational Funding Council for England*) provides funding to support the research infrastructures, including the salaries of permanent academic staff, premises, libraries and central computing costs. These funds are spent at the institutions' discretion.

Universities are also able to contribute directly to the research infrastructures by allocating funds received from the SRIF (*Science Research Investment Fund*) to areas of specific interest, such as those, recently, used to form the UK SALT Consortium, in order, to participate in the South African Large Telescope.

The Royal Society has a grand total budget of approximately £40 million, both from the Department of Trade and Industry and from private sources. Of this £40 million, approximately 80% is spent by the Royal Society on supporting excellent scientists through a variety of grants and fellowships; astronomers are eligible to receive this funding. The Royal Astronomical Society awards grants in support of studies in astronomy and geophysics.

Personnel

Most UK astronomers have staff positions at university Departments of Physics and Astronomy.
In 2003, 387 professional astronomers (17% female) had permanent staff positions in UK institutions sponsored by PPARC grants. New positions are offered within universities following the local rules.

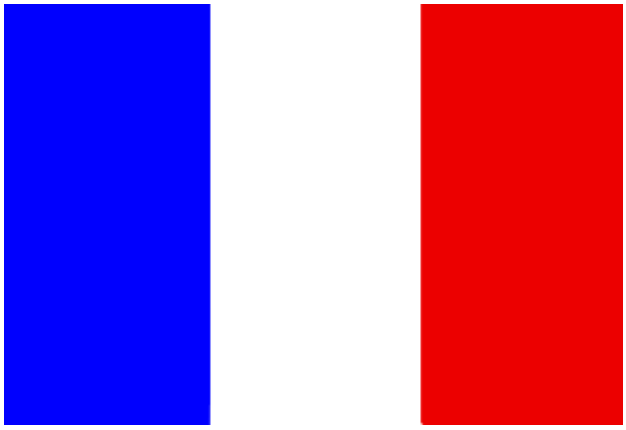
The Numbers in UK Astrophysics

	Body	Gender	Staff	Non-permanent Positions
Researchers	**Universities**	Male	321	n/a
		Female	66	n/a
		Total	**387**	**415**

	Body	Salaries (Researchers)	Running Costs	Infrastructures	Research Grants
Funding	**PPARC**	8.5 M£	n/a	17.7 M£	36.3 M£

	Organisation	Appointing Institution	Membership Budget
International Memberships	**ESA**	PPARC	55.2 M£
	ESO	PPARC	17.5 M£

n/a: Not available



Chapter 2

The Management of French Astrophysics

An overview of the organisation of the research system in France

The French public research system is under the authority of the Ministry of Youth, National Education and Research (*Ministère de la Jeunesse, de l'Education Nationale, et de la Recherche*), which is incharge of both the definition of the scientific policy as well as of the allocation of the relevant funds. It also supervises the public bodies (*Établissements Publics*) that perform research.

ÉTABLISSEMENTS PUBLICS

EPST
Établissements publics à caractère scientifique et technologique
(Public Bodies for Science and Technology)

EPIC
Établissements Publics à caractère Industriel et Commercial
(Public Bodies for Industry and Trade)

EPA
Établissements Publics à caractère Administratif
(Public Bodies for Administrations Matters)

Fondations
(Foundations)

GIP
Groupements d'Intérêt Public
(Groups of Public Interest)

Établissements de Recherche dans le Monde
(Establishments of Research in the World)

Établissements d'Enseignement Supérieur et de Recherche
(Higher Educational and Research Establishments)

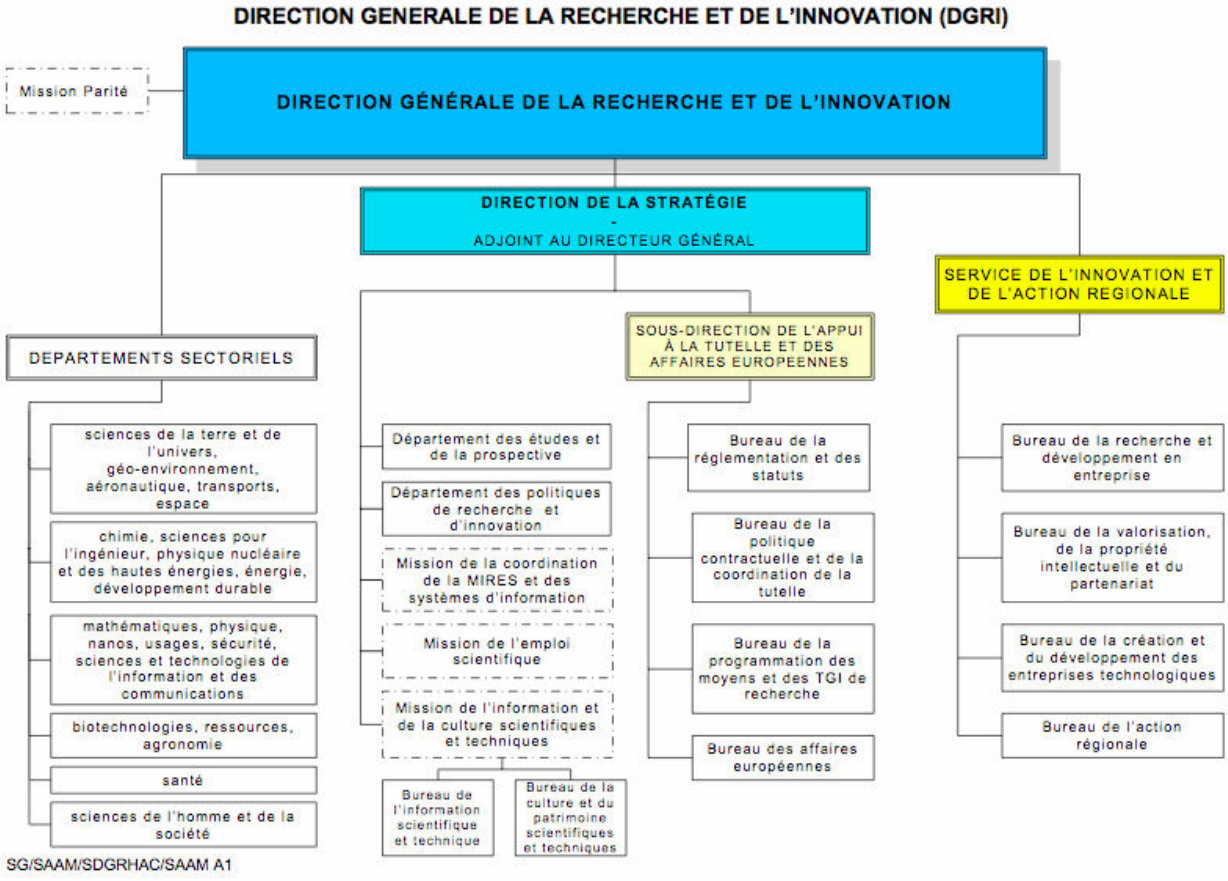
EPCSCP
Établissements Publics à Caractère Scientifique, Culturel et Professionnel
(Scientific Cultural and Professional Public Bodies)

There are six types of such public bodies that perform research activities and two for education, as described in the table.

At the present time, there is a Deputy Ministry for Research and Technology (*Ministère délégué à la Recherche et aux Nouvelles Technologies*) but, in the past, there were governments with a full Ministry for Research and another full one for Education.

The Ministry of Defence (*Ministre de la Défense*) and the Ministry of Industry (*Ministre*

délégué à l'Industrie) also play a role on researches close to their institutional activities.



Organisation chart of the current Ministry of Youth, National Education and Research

2.1 The Players in French Astronomy and Astrophysics

The research activities in astronomy and astrophysics are mainly performed by laboratories, the **UMR** (*Unité Mixte de Recherche,* Joint Research Units) which are joint ventures between public research bodies and universities. There are about 40 UMRs involved in astronomy and astrophysics and astroparticles.

The national bodies

Besides universities, the national research institutes involved in astronomy based UMR are:

- **CNRS** *Centre National de la Recherche Scientifique*, (National Center for Scientific Research) (EPST)
- **CEA** *Commissariat à l'Energie Atomique*, (Commissariat for Atomic Energy) (EPIC)
- **CNES** *Centre National d'Etudes Spatiales* (National Centre of Space Studies) (EPIC)

The national astronomy policy is under the responsibility of **INSU** (*Institut National des Sciences des l'Univers,* National Institute of Universe Sciences), inside the CNRS. It is incharge of defining the national astronomy and earth sciences research programmes and strategic plans on behalf of the Ministry of Education and Research.

A high-level committee provides coordination between CNES, CNRS and other research institutes about projects and infrastructures.

2.1.1 Centre National de la Recherche Scientifique

The largest national research organisation is the CNRS – National Center of Scientific Research. It deals with fundamental research and acts under the administrative supervision of the Ministry of Research.

The organisation is led by the President and the Director General, both appointed by the Ministry of Research, who are advised by the *Comité National de la Recherche*, formed by:

- The CNRS Scientific Council (CS),
- Scientific Councils of thematic Departments (CSD)
- 40 thematic Sections.

These Sections are incharge of scientific evaluations in specific domains. For example, Section 17 is incharge of astrophysics, while Section 03 is incharge of particle physics. Both are involved in cosmology.
Each Section is composed of 21 members of which two-thirds are elected every 4 years; the other members are appointed. Their main activities are:

- evaluation and proposal of candidates for permanent research positions at CNRS;
- making recommendations to the Direction of CNRS;
- evaluation of the activities of the laboratories and researchers;

They also have an important role in elaborating the strategic planning of the CNRS.

CNRS DEPARTMENTS

MIPPU
Département scientifique Mathématiques, Physique, Planète et Univers
(Department of Mathematics, Physics, Earth Sciences and Astronomy)

SC
Département scientifique Chimie
(Department of Chemistry)

SDV
Département scientifique Vivant
(Department of Life Sciences)

SHS
Département scientifique Homme et société
(Department of Humanities and Social Sciences)

EDD
Département scientifique Environement et développement durable
Department of Environmental Sciences and Sustainable Development)

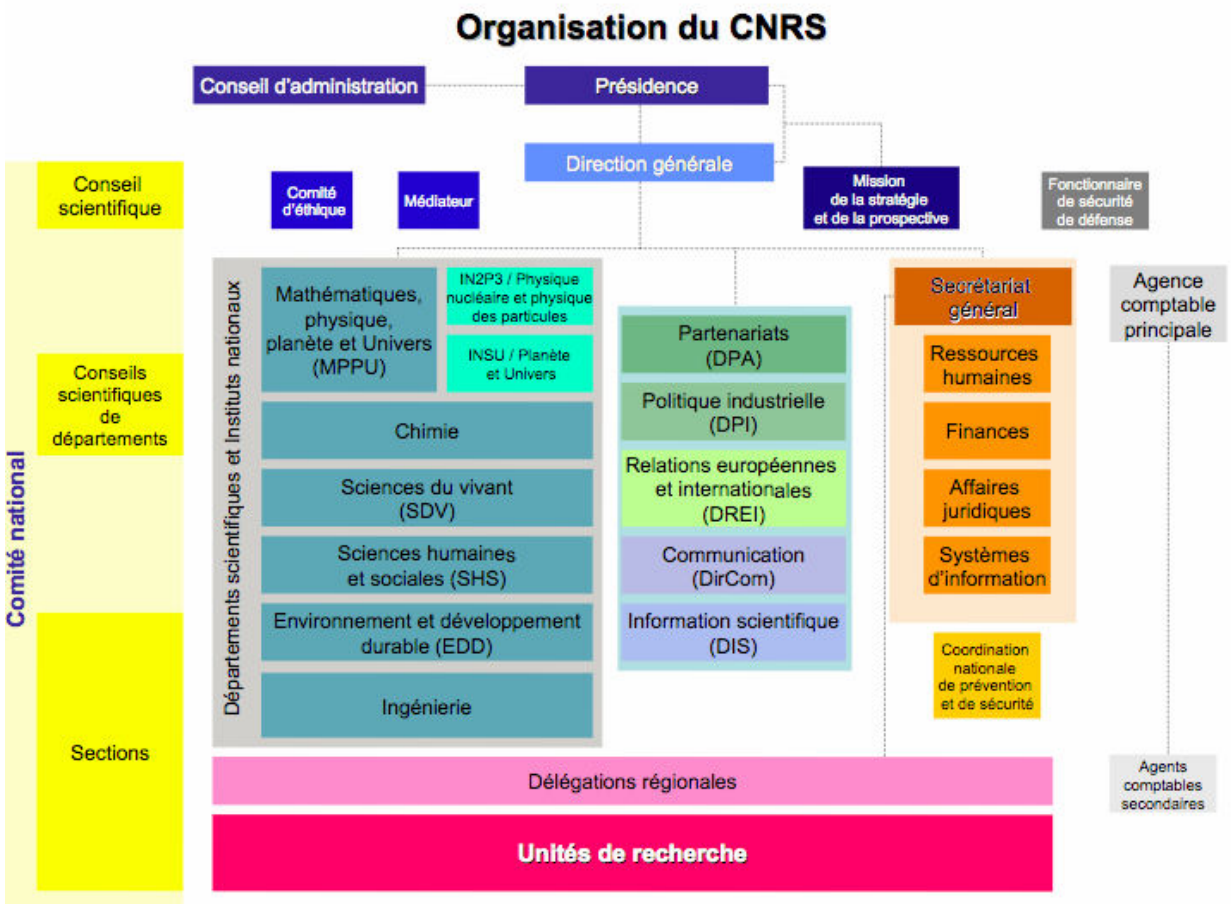
ST2I
Sciences et technologies de l'information et de l'ingénierie
(Information and Engineering Sciences)

CNRS INSTITUTES

INSU
Institut National des Sciences des l'Univers
(National Institute of Universe Sciences)

IN2P3
Institut National de Physique Nucléaire et de Physique des Particules
(National Institute of Nuclear and Particle Physics)

The research activities are performed by about 30,000 persons, among which are 12,000 researchers and 14,000 engineers and technicians in permanent positions.



2.1.1.1 INSU - *Institut National des Sciences des l'Univers*

INSU was founded in 1985 to coordinate the national and international research in astronomy and earth sciences by providing resources for very large research infrastructures, telescopes, aircrafts, instruments, long-term observation systems, databases and national and international partnerships.

INSU is organized by sections (astronomy-astrophysics, ocean-atmosphere, earth sciences, continental surfaces and interfaces). The INSU astronomy and astrophysics section covers conventional astronomy and astrophysics. Researches on solid planets as well as the chronology of the Solar System also involve geologists and geochemists from the earth sciences domain.

The Institute is headed by a Scientific Director, appointed by the Ministry of Research and the Ministry of Higher Education. The activities are managed by sections, each led by a Deputy Director.

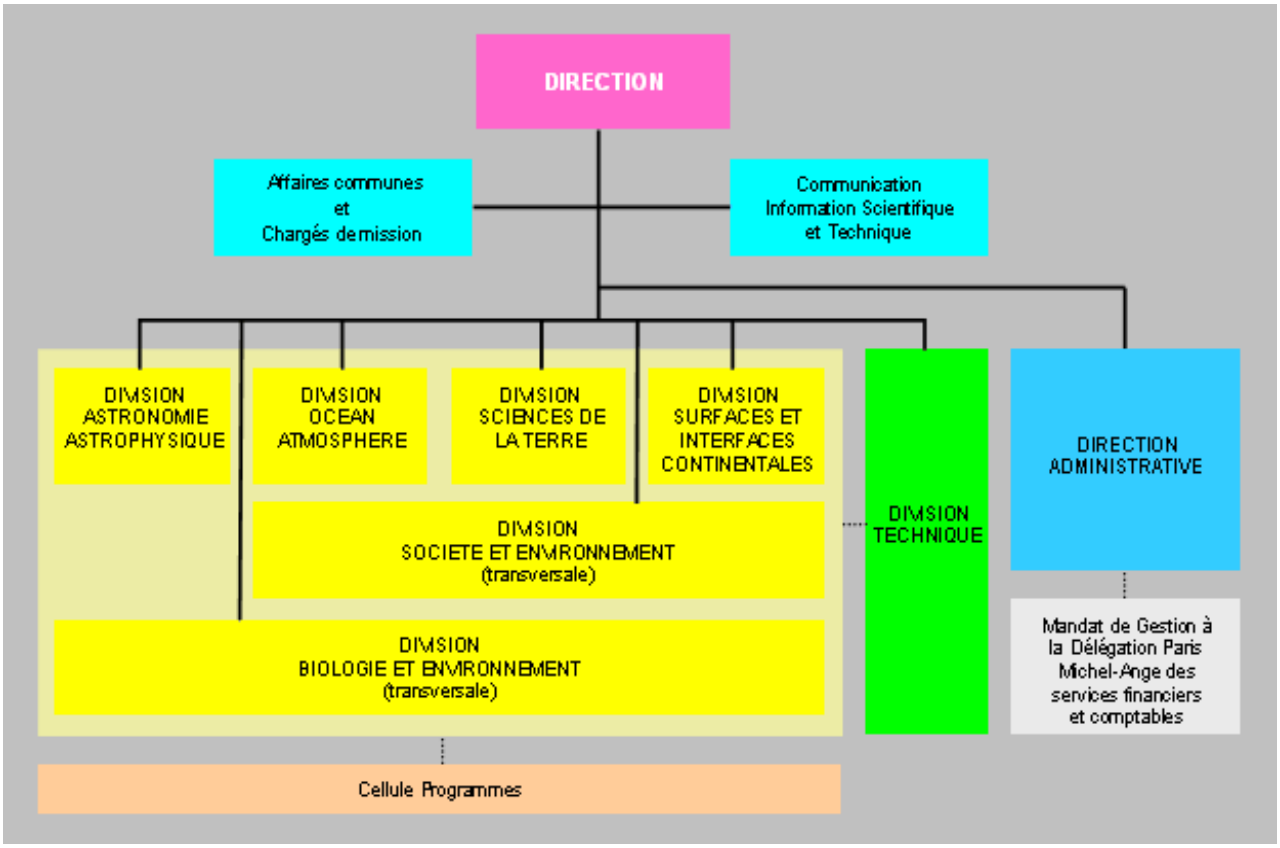
The direction is advised by two bodies:

- Council
- Scientific Council, with specialized committees.

The Council is consulted on the settlement of research programs, the statement of plan and programs of equipment, budget, and the structuring of laboratories into *Observatoires des Sciences de l'Univers* (OSU).

The Scientific Council advises on the implementation of research programs with CNRS departments and other research bodies, and on the implementation of plans and programs of equipments. Two-thirds of the CS are elected and one-third are appointed.

The CSA (*Commission Spécialisée Astronomie*), a committee of the CS, reviews and makes recommendations on the allocation of money to proposals and on research programs. CSA also plays a major role in the strategic planning.



The INSU Strategic Planning

The strategic planning is initiated by the INSU Deputy Director, incharge of astronomy, every 5-6 years. A mid-term review may be initiated as well if necessary.

The strategic planning lasts for about one year and involves the CSA, the thematic programs, the laboratories and observatories, the CNRS Sections incharge of astronomy ("Section 17") and a number of ad-hoc committees depending on the pending issues (such as the future of national facilities, R&D, education, outreach…). After some feedback from the community, the final recommendations are discussed in a meeting open to the community. Finally, the document becomes public and is published on the INSU website.

2.1.1.2 IN2P3 - *Institut National de Physique Nucléaire et de Physique des Particules*

The IN2P3 (*Institut National de Physique Nucléaire et de Physique des Particules*) performs the same kind of activities as INSU in the fields of nuclear and particle physics researches. Astro-particle physics and cosmology are part of IN2P3 interests. There are also a number of researchers in theoretical physics working in this domain.

The IN2P3 Strategic Planning

The IN2P3 strategic planning is currently provided every 2 years. One of the IN2P3 Deputy Directors is incharge of its development, carried out in collaboration with the CEA – Commissariat for Atomic Energy. He appoints the thematic panels and submits proposals and conclusions to "Section 03" and to the CS. There is a final meeting where the documents are discussed. The final document is posted on the web. Starting from 2007, this planning will take place every 4 years.

2.1.2 The Commissariat for Atomic Energy

Interests of CEA span over fundamental research in physical sciences, among which is astrophysics.

The governance of the body is based on a Board whose members are representatives of State, as is the Director, persons elected by the employees and persons appointed for their scientific competence. Board members are appointed for 5 years. The Board is in charge of the strategic economics, financials or technical orientations.

The Executive Committee is composed of a Head division, supported by a Chairman and a Vice-Chairman, and a High-Commissioner for atomic energy. The Head division is incharge of the operational sectors such as defence, nuclear, technological research and basic research and of the functional sectors

such as risk control, strategy and external relations, information management and systems, human resources and training.

The Scientific Council assists the High-Commissioner for atomic energy on the evaluation of research activities and on the definition of scientific priorities.

2.1.3 Centre National d'Etudes Spatiales

The *Centre National d'Etudes Spatiales* (National Center for Space Studies, CNES) is the government agency responsible for shaping and implementing France's space policy in Europe. Its task is to invent the space systems of the future, to bring space technologies to maturity and to guarantee France's independent access to space.

The governance of the body is based on a Board, composed of a President, members appointed by the Prime Minister and the Ministers of: Industry, Budget, Defence, Foreign Affairs, Space and Research and members elected by the employees.

A pluriannual State-CNES contract (currently 2005-2010) is signed between CNES and the Ministry for Higher Education and Research, the Ministry of Defence, and the delegate Ministry of Budget. The contract defines the strategic vision of CNES, the programs priorities at short-, medium- and long-term and guarantees the resources allocated.

For the scientific program, CNES has set up several advisory committees: astronomy, Solar System, SHM (Sun, Heliosphere, Magnetosphere), fundamental physics. Members of these ad-hoc committees are chosen by CNES. Such committees do not allocate funds directly but evaluate and give advice on the projects; space projects are chosen and funded by the Board after recommendations by the *CPS - Comité des Programmes Scientifiques*.

CNES manages a total annual budget of 1.7 billion euros, including the French contribution to ESA (685 million euros). CNES operates following a strategic plan that is fixed every 4 or 5 years.

CNES also contributes to the funding of some of the INSU thematic research programs. Note that INSU does not fund projects directly linked to space programs, except at the Research & Development phase.

2.1.4 The Universities and Observatories

Some universities have astronomy or physics departments where the astrophysical studies are performed, typically within UMRs. Some of them own observatories with telescope facilities. The main ones having astronomy departments are:

- Université Denis Diderot (Paris)
- Université Pierre & Marie Curie (Paris)
- Ecole Normale Supérieure de Paris
- Université Louis Pasteur (Strasbourg)
- Université de Provence (Marseille)
- Université Paul Sabatier (Toulouse)
- Université de Nice Sophia Antipolis
- Université Joseph Fourier (Grenoble)
- Université Claude Bernard (Lyon)
- Université Paris-Sud 11
- Université Bordeaux 1
- Université D'Orléans
- Université de Montpellier
- Université Cergy Pointoise
- Université de Versailles Saint Quentin
- Université de Franche-Comté (Besançon)

Two Observatories are independent legal entities with a specific status:

- Observatoire de Paris
- Observatoire de la Côte d'Azur.

Other observatories are groups of UMRs set up by the Ministry of Research with, in addition, a technical and administrative group, or, in a few cases, national observation stations.

2.1.5 UMR The Unité Mixte de Recherche

Laboratories can be under the authority of a university, observatory or of CNRS, but, generally, they are under the authority of all. This means that in the laboratories, there are personnel paid by the CNRS and personnel paid by the university while the operating funds, in principle, come from both. The laboratories, generally, have 4-year contracts with their authorities that guarantee a certain level of operating funds and some funding for equipments.

The following list shows the partnerships of mixed research units involved in the astrophysical domain, i.e. those evaluated by Section 17 of CNRS. Other UMRs involved in astroparticle researches are not shown.

List of UMR involved in Astronomy		
UMR5024	Groupe de recherche en astronomie et astrophysique du Languedoc (GRAAL)	Université Montpellier 2 CNRS
UMR5109	Laboratoire de Planétologie de Grenoble	CNRS Université Grenoble1
UMR5187	Centre d'étude spatiale des rayonnements (CESR)	CNRS Université Toulouse 3
UMR5562	Dynamique terrestre et planétaire	CNRS Université Toulouse 3
UMR5571	Laboratoire d'astrophysique de Grenoble (LAOG)	CNRS Université Grenoble1
UMR5572	Laboratoire d'astrophysique de Toulouse et Tarbes	CNRS Université Toulouse 3
UMR5574	Centre de recherche astronomique de Lyon	CNRS Université Lyon 1 Ecole Normale Supérieure Lyon
UMR5804	Laboratoire d'astrophysique de Bordeaux (L3AB)	Université Bordeaux 1 CNRS
UMR6110	Laboratoire d'Astrophysique de Marseille (LAM)	Université Aix-Marseille 1 CNRS
UMR6115	Laboratoire de physique et chimie de l'environnement (LPCE)	CNRS Université d'Orléans
UMR6162	Astrophysique Relativiste, Théories, Expériences, Metrologie, Instrumentation, Signaux (ARTEMIS)	Observatoire de la Côte d'Azur CNRS
UMR6202	Laboratoire Cassiopée de cosmologie, astrophysique stellaire et solaire, de planétologie et de mécanique des fluides	Observatoire de la Côte d'Azur CNRS
UMR6203	Laboratoire Gemini	Observatoire de la Côte d'Azur CNRS
UMR6213	Institut Bisontin en Sciences Fondamentales	CNRS Université Besançon
UMR6525	Laboratoire Universitaire d'Astrophysique de Nice (L.U.A.N.)	CNRS Université Nice
UMR6627	Physique des atomes, lasers, molécules et surfaces (PALMS)	CNRS Université Rennes 1
UMR7092	Laboratoire de physique moléculaire pour l'atmosphère et l'astrophysique	CNRS Université Paris VI
UMR7095	Institut d'Astrophysique de Paris (IAP)	CNRS Université Paris VI
UMR7158	Astrophysique interactions multi-échelles (AIM)	CNRS Université Paris VII

UMR7164	Astroparticule et Cosmologie (APC)	CEA Université Paris VII Observatoire de Paris CNRS
UMR7550	Observatoire astronomique de Strasbourg	CNRS Université Strasbourg 1
UMR7583	Laboratoire inter-universitaire des systèmes atmosphèriques (LISA)	CNRS Université Paris VII Université Paris XII
UMR7644	Centre de physique théorique	CNRS Ecole Polytechnique
UMR8028	Institut de mécanique céleste et de calcul des éphémérides	Observatoire de Paris CNRS Université Paris VI Université Lille 1
UMR8102	Laboratoire de l'univers et de ses théories (LUTH)	CNRS Observatoire de Paris Université Paris VII
UMR8109	Laboratoire d'Etudes Spatiales et d'Instrumentation en Astrophysique (LESIA)	CNRS Observatoire de Paris Université Paris VI Université Paris VII
UMR8111	Galaxies, Etoiles, Physique, Instrumentation (GEPI)	CNRS Observatoire de Paris Université Paris VII
UMR8112	Laboratoire d'étude du rayonnement et de la matière en astrophysique (LERMA)	CNRS Observatoire de Paris Université Cergy Pontoise Université Paris VI Ecole Normale Supérieure
UMR8523	Laboratoire de physique des lasers, atomes et molécules (PhLAM)	CNRS Université Lille1
UMR8539	Laboratoire de météorologie dynamique (LMD)	CNRS Ecole Polytechnique Université Paris VI Ecole Normale Supérieure
UMR8617	Institut d'astrophysique spatiale (IAS)	Université Paris XI CNRS
UMR8630	Systèmes de référence temps-espace (SYRTE)	Observatoire de Paris CNRS Université Paris VI
UMR8639	Centre d'étude des environnements terrestre et planétaires (CETP)	Université Versailles St-Quentin Université Paris VI CNRS
UMR7620	Service d'Aéronomie (SA)	Université Versailles St-Quentin Université Paris VI CNRS

2.2 The French Astronomy @ Main European Organisations

2.2.1 The French membership

The funding for the French membership to ESA is fully covered by CNES. The representation at the ESA decisional Boards are shown in the following table:

@ ESA Boards	
ESA BOARD NAME	**APPOINTING INSTITUTION**
Ministerial Level Council	Ministry of Research
Council	CNES
SPC	CNES

2.2.2 The French membership

The funding for the French membership at ESO is directly provided by the Ministry of Foreign Affairs. The French representation at the ESO decisional Board is shown in the following table:

@ ESO Council	
POSITION	**APPOINTING INSTITUTION**
Political Member	Ministry of Foreign Affairs and Ministry of Research
Scientific Member	Ministry of Foreign Affairs and Ministry of Research

2.3 The Funding

The French research public funding system is based on these main baselines:

- Ministry funding to public bodies and universities
- Public body and university fundings to laboratories and teams
- Ministry targeted funding (pôle de compétitivité, and other networks)
- Regional and local fundings
- EU funding

The core funding

The funds, to guarantee the operations of the national research institutes, are provided directly by the government. National institutes, agencies and universities are funded by the relevant ministry. The budget is based on a four year contract between the body and the ministry.

The programme funding

2.3.1 ANR AGENCE NATIONALE DE LA RECHERCHE — The Agence Nationale de la Recherche

In 2005, the French government had created the ANR – National Research Agency (*Agence Nationale de la Recherche*). This agency issues several calls for research proposals once a year. Most of these calls are for targeted programs, but, almost one third of the budget (that is, 160 M€ in 2005) is devoted to non-targeted programs (*programme blanc*) that are divided in the following calls:

- *chaires d'excellence*, for foreign researchers that just received permanent positions in France
- a program targeted towards young researchers (under 37 yrs old)
- a general non-thematic program.

ANR funds equipment and non-permanent positions for up to 4 years (Ph.D. students, postdocs, technicians and engineers) but, does not fund infrastructures nor permanent positions.

The call for proposals is annual and funds 3 - 4 years projects. It is open to teams composed of several groups of researchers in different laboratories. The announcements are put up on the ANR, Ministry of Education and INSU websites. The deadline is in January.

The evaluation is performed by a committee of designated people helped by at least 2 external reviews.

2.3.3 Institut National des Sciences des l'Univers

The two national institutes of the CNRS, INSU and IN2P3, fund research programmes under the authority of CNRS and the Ministry of Research.

INSU allocates a budget of about 12 M€ per year devoted to astronomy, including partnerships of international facilities such as IRAM, CFHT, THEMIS, EISCAT. Such funding is based on the strategic planning described above.

It issues a call for proposals based on the thematic priorities of the national astronomy plan (*programmes nationaux*) and on topics in the plan. The call is open to groups of researchers to fund 1 – 2 years projects. In this last case, it is reviewed every year.

The evaluation is done by the CSA - Astronomy Scientific Committee - using external referees, as needed. The call is announced by mail to the laboratories and on the INSU website. The deadline is in October and the funds are allocated the following April.

2.3.4 The Centre National d'Etudes Spatiales

CNES funds research related to space activities by supporting R&D programs, building instruments, managing databases, providing equipment at calibration facilities for scientific space missions, performing scientific analysis and funding non-permanent personnel such as engineers, technicians, Ph.D. thesis and postdocs.

There is an annual call for proposals open to groups of researchers and laboratories. The deadline is at the end of April.

Projects lasting more than one year are submitted for a yearly review that takes into account the CNES strategic planning. The proposal selection is performed by the relevant thematic committee with no external referee.

2.3.5 EU funds

Laboratories and research teams, generally, apply to EU calls. In networking calls, as RADIONET for example, the French members are laboratories that manage a radio-telescope. For structures that require an agency membership, as OPTICON, INSU represents French astronomy.

The EU Structural Funds

The ESF and ERDF are managed by local committees established through contacts between the laboratories and the local Préfecture. Such funds have, for example, been used to improve the Nançay Radio-Telescope several years ago.

2.3.6 Regional and local public funds

Some regions provide calls for proposals, generally open each year, to fund Ph.D., postdocs, equipments, conferences, etc. but, never permanent personnel. The evaluation of the application is performed by a committee that takes advantage of external referees. Some of the regions have largely supported astronomy: Rhône-Alpes, PACA, and Ile de France:

PACA:
often funds R&D projects and instrumentation: e.g. ESO instrumentation, Observatoire de Haute Provence instrumentation, and IRAM Plateau de Bure 6th antenna

Rhône-Alpes:
participated to the IRAM 6th antenna

Ile de France:
funds postdocs, Ph.D. theses, conferences or helps in preparing the FP6 proposals.

The pluriannual joint investment plan by the French state and regions, the *Contrat de Projet Etat-Region* (CPER) has a research and higher education section. The next one, for 2007-2013, is in preparation.

Pôle de compétitivité

Competitiveness clusters are new structures introduced in 2004. They are formed on the basis of local synergies between the industry, research and training communities.

This tool is not just intended for emerging technologies (nanotechnologies, biotechnologies, microelectronics, etc.) but, also for more mature sectors (automotive and aviation industry, etc.). Clusters must also fit into the international environment, primarily the European market, to create balanced partnerships with foreign players of the EUREKA programme.

The budget is 1.5 billion € for 3 years for all domains. The state part is entirely managed by a unique interministerial fund.

A small number of astronomy laboratories are part of the "*pole de competitivité*", at present time (e.g. LAM in Marseille).

2.3.7 Private funds

No significant funding for astronomy from private companies.

Detailed Funding Data

Funding Summary		
	Budgetary cost (M€)	PLEASE REMOVE THIS COLUMN
Technical and administrative staff (permanent and non-permanent)	56	
Researchers (CNRS, Univ., CNAP)	58	Including astroparticle labs
Postdocs and Ph.D.	8.5	
CNRS and INSU running costs and Research projects (MIPPU, SPU, INSU)	8	
Universities: running costs and research projects	5	
ESO (via Foreign Affairs)	17	
ESA	61	
Large scale facilities INSU	9	
ANR astronomy	6	Includes postdocs
CNES	42	Includes ESA payloads
CNES staff	11.0	73 ETP, includes overheads
CEA staff and research projects	19	Includes Ph.D. students, postdocs, and overheads
Regions	2	
EU-funded projects	2.5	OPTICON, RADIONET, ILIAS, DS…
Total	**299**	

Research Grants Summary

Source	Title or type	Theme	Target	Deadlines *					Evaluation	2005			
				1	2	3	4	5		Follow up	Proposals	Approved	Amount M€
ANR	programme blanc *"chaires d'excellence"*	no	Foreign researchers with positions in France	Jan	Mar	Jun	Sep	Sep	Appointed members committee 2 external reviews		0	0	0
	programme blanc	no	Young researcher s (or teams) < 37 yrs old	Jan	Mar	Jun	Sep	Sep	Appointed members committee 2 external reviews	Reports due in July	13	4	0.5
	programme blanc 3 yrs prg	no	Teams	Jan	Mar	Jun	Sep	Sep	Appointed members committee 2 external reviews		28	12	5.1
INSU	1-5 yrs projects	National Astronomy Plan	Research teams and labs	Sep	Oct	Jan	Apr		- Astronomy Scientific Committee (CSA) - Strategic Plan - No external referee	Reports yearly			3
	Thematic programs (programmes nationaux) 1-2 yrs projects		Research teams and labs	Sep	Oct	Jan	Apr		Thematic program advisory council	Reports yearly			2.5
IN2P3													
CNES	Instrument and equipment provider			Mar	Apr								
CEA													

* LEGEND						
label	1	2	3	4	5	6
Phase	call announcement	deadline	evaluation	granting	start-up	report

Facilities core costs

	Facility	Location	Capital Costs M€		Ops Costs M€		Part. %	Funding Agencies M€
			2004	*2005*	*2004*	*2005*		
National Facilities								
	NRT				2.5	2.5	100	CNRS+MEN
	OHP				3.8	3.8	100	CNRS+MEN
	TBL				0.95	0.95	100	CNRS+MEN
International Facilities	**ANTARES**	France					25	
	CFHT	USA			5.31	5,.39	45	Total: ***6.2*** MUSDD 2004: ***6.3*** MUSD 2005: plus ***0.35*** additional from CNRS 2004 et 2005
	EDELWEISS	Italy					50	
	EGO	Italy	2.6	3.1	6.4	6.9	50	
	ESO	Chile		0.5	17	17	16.9	
	HESS	Namibia	0.3	2.7	0.7	1.5	12	
	IRAM	France & Spain	1.6	1.6	10.45	10.45	47	
	Pierre Auger	Argentina			0.3	0.3	6	
	SuperDarn	Arctic & Antarctic			0.05	0.05	10	
	THEMIS	Spain	0.04	0.05	1.0	1.0	80	

2.4 The Personnel

Research staff positions in universities and research institutes are divided into five different levels. All researchers in public bodies are civil servants hired by public contests that can be different for each body.

Public Bodies' Personnel

	Role		#	% Female	Salary €	Cost €	Age
Technical Staff	*Technicians*		152		**g.** 1300÷2400		
	Engineers		416		**g.** 1700÷4450		
	CDD		20		= ing		
Student	*Ph.D.*		≈30		**g.** 1439 **n.** 1151	3930	
	Postdocs		≈15		**g.** 2134 **n.** 1707	2617	
Scientific Staff	CR2	*Chargé de Recherche de deuxième classe* 2nd 2nd class Associate Scientist	22		**g.** 2147÷2653 ***n.*** 1717÷2123	4045÷5029	
	CR1	*Chargé de Recherche de première classe* 1st class Associate Scientist	141		**g.** 2266÷3849 ***n.*** 1812÷3078	4266÷7322	
	DR2	*Directeur de Recherche de deuxième classe* 2nd class Senior Scientist	119		**g.** 3120÷4511 ***n.*** 2495÷3609	5912÷8592	
	DR1	*Directeur de Recherche de première classe* 1st class Senior Scientist	28	22	**g.** 3884÷5394 ***n.*** 3107÷4314	7372÷10310	48.8
	DRCE	*Directeur de Recherche de classe exceptionnelle* Exceptional Class Senior Scientist	4		**g.** 5394÷6104 ***n.*** 4314÷4883	10310÷11681	

Universities' Personnel

	Role	Male	Female	Salary €	Cost €	Age
Technical Staf	*Technicians*	290		g: 1,300-2,400		
	Engineers	154		g: 1,700-4,450		
Student	*Ph.D.*	185				
	Postdocs					
Scientific Staff	*Maître de conferences* Lecturer	75	27	g: 2,147 – 3,884 n: 1,717 – 3,107	4,045 – 7,372	45
	Maître de conferences hors classe Lecturer exceptional class			g: 3,120 – 4,511 n: 2,495 – 3,609	5,912 – 8,592	
	Professeur de deuxième classe 2nd class Professor	46	12	g: 3,120 – 4,511 n: 2,495 – 3,609	5,912 – 8,592	53
	Professeur de première classe 1st class Professor			g: 3,884 – 5,394 n: 3,107 – 4,314	7,372 – 10,310	
	Professeur de classe exceptionnelle Exceptional class Professor			n: 5,394 – 6,104 g: 4,395 - 4,883	10,310 – 11,681	

g= gross salary ; **n**=net salary

There are, also, special classes of researchers, valid for the astronomy and earth sciences domain:

Astronomers					
Role	*Male*	*Female*	*Salary €*	*Cost €*	*Age*
Astronome-adjoint Assistant Astronomer	92	25	g: 2,147 – 3,884 n: 1,717 – 3,107	4,045 – 7,372	41
Astronome-adjoint hors classe Exceptional class assistant Astronomer			g: 3,120 – 4,511 n: 2,495 – 3,609	5,912 – 8,592	
Astronome de deuxième classe 2nd class Astronomer	91	29	g: 3,120 – 4,511 n: 2,495 – 3,609	5,912 – 8,592	54
Astronome de première classe 1st class Astronomer			g: 3,884 – 5,394 n: 3,107 – 4,314	7,372 – 10,310	
Astronome de classe exceptionnelle Exceptional class Astronomer			g: 5,394 – 6,104 n: 4,395 – 4,883	10,310 – 11,681	

g= gross salary; **n**=net salary

2.4.1 Centre National de la Recherche Scientifique

The CNRS opens new positions each year. The total number of positions for all disciplines is determined by the ministry. The number of positions for each discipline and level is decided by the CNRS. In 2006, for example, astronomy had 7 new positions at the CR2 level and 2 at the CR1 level. There are also some positions at the DR2 level. The positions may be labelled with thematic priorities or for a given laboratory. CNRS researchers do not have teaching duties.

The enrolment is performed by a national competition that takes place in the spring. Candidates are selected by a committee ("section") composed of two-thirds elected people (researchers) and one-third designated (4 year duration). In principle, the CNRS designates the laboratory where the successful candidate is assigned.
For the time being, the number of open positions are slightly below what would be needed to replace for retirements.

The CNRS researchers mobility inside the centre (among CNRS laboratories), or in international organisations while being paid by CNRS, is subject to the approval of the Section.

2.4.3 The Universities

The competition is local in each university.
When there is a retirement, the university re-opens the position in the same field or another (following the decision of the councils of the university). The competition takes place during spring. The teaching skills of the candidates must have been agreed upon by the astronomy section of the national committee called CNU. They are selected by a local commission with a variable proportion of elected and nominated members.

University employees cannot move from one university to another, unless there is a position opened and they go through the process successfully, as candidates. They are supposed to devote half of their time to their teaching duties.

2.4.3 CNAP Conseil National des Astronomes et Physiciens

CNAP is the body incharge of recruiting Astronomers and Assistant Astronomers. Each year, the *Ministère de la Recherche et de l'Enseignement Supérieur* opens a number of positions close to the number of retirements. The position is not assigned a priori to a specific field. A Committee for astronomy, composed of two-thirds elected and of one-third nominated members, selects the candidates and decides on the destination laboratory from a list of observatories defined by the Ministry, which is based on the advice of INSU.
It has to be noted that 1/3 of the working time of Astronomers has to be devoted to functional duties such as: building instruments for large or space telescopes, managing databases of large surveys, etc. They also have some teaching duties.
Astronomers can move from one observatory to another by CNAP approval.
They can also work in international organisations while being paid by the Ministry of Higher Education.

Chapter 3

The Management of German Astrophysics

An overview of the organisation of the research system in Germany

The federal system of Germany implies the division of roles in education and research between the federal and the state governments. By constitution, the federal states (*Länder*) have the sovereignty for culture, which includes education and science. Universities are thus within the sovereignty of the Länder. They are responsible for the core funding and human resources of universities and also have a share in research funding. The federal government is responsible for research of national interest or in strategic fields.

The federal government uses different instruments to support research and development: targeted project funding for short- and mid-term research on one hand, and mid- to long-term institutional funding of large research organisations on the other hand. The main federal ministries involved in science funding are: the Ministry of Education and Research (*BMBF, Bundesminsiterium für Bildung und Forschung*) and for Space Research the Ministry of Economics and Technology (*BMWi, Bundesministerium für Wirtschaft und Technologie*). As a federal ministry, the BMBF bears a special responsibility for education and research. It is the largest single funding agency for science and research in Germany.

In fields of national interest the Länder can waive (part) of their sovereignty and share the funding of certain institutions with the federal government. Based on mutual agreements between the Länder and the federal government, institutions with shared funding like Max-Planck-Gesellschaft, Helmholtz-Gemeinschaft, etc. were founded. The joint research funding is graphically depicted in the next figure.

In 1970, the Bund-Länder Commission (BLK) was established by an Administrative Agreement between the federal and Länder governments and

renamed in 1976 to Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung (BLK, Bund-Länder Commission for Educational Planning and Research Promotion) (see Figure below). The BLK is an intergovernmental commission and cooperates closely with the various Conferences of Länder Ministers. It is a permanent forum for the discussion of all questions in research promotion which are of common interest to the federal and Länder governments. It makes recommendations to the Heads of the federal and Länder governments on educational planning and research promotion. The basis for the activities is an article of the Basic Law (Article 91 b), according to which the federal and Länder governments may, on the basis of agreements, cooperate in the promotion of research institutions and research projects of supra-regional importance. In the course of the reform of the federal system, the duties of the BLK will probably change.

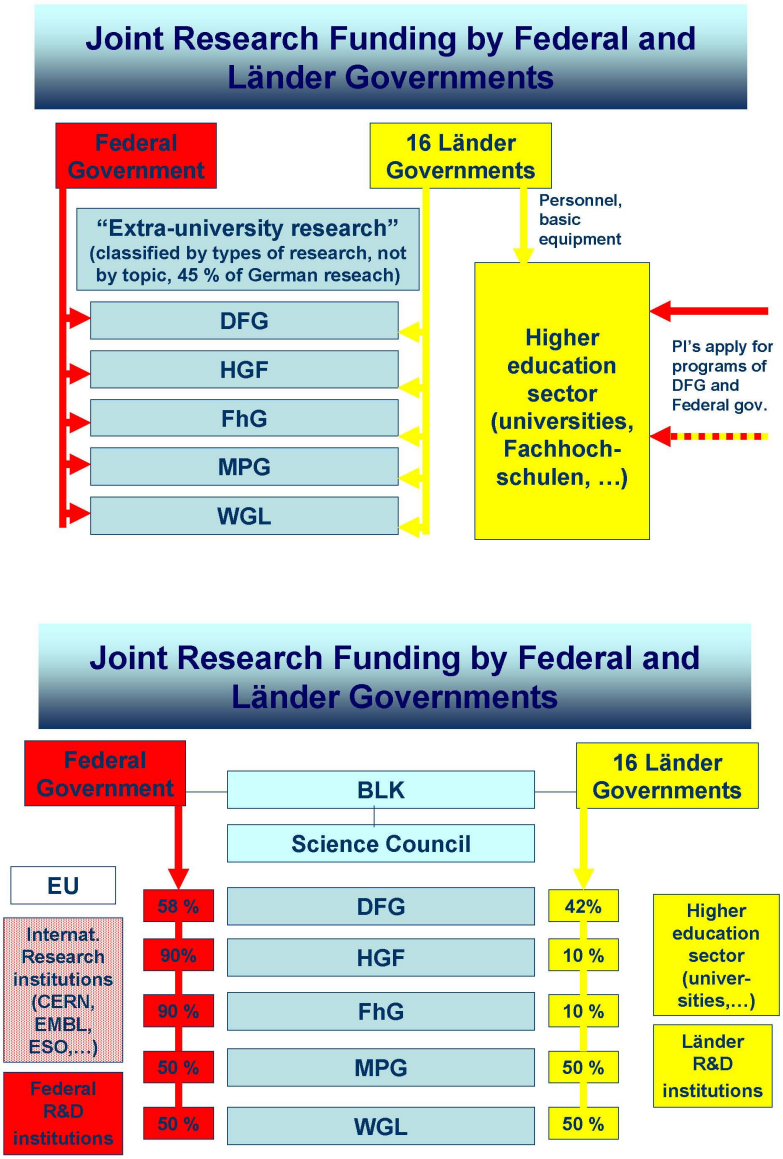
The Wissenschaftsrat (Science Council) is an advisory body to the federal government and the state (Länder) governments (see figure). Its function is to draw up recommendations on the development of higher education institutions, science and the research sector as regards to content and structure, as well as on the construction of new universities. The Wissenschaftsrat is co-funded by the federal government and the governments of the 16 Länder. It consists of two commissions, the Scientific Commission and the Administrative Commission, which meet in the Plenary Assembly to take decisions, in particular, for the adoption of recommendations and reports. The members of the Scientific Commission are appointed by the Federal President.

The Wissenschaftsrat issues statements, recommendations and prepares reports which primarily concern the two major fields of science policy, namely a) the scientific institutions (universities, universities of applied sciences and non-university research institutions), in particular, their structure and performance, development and financing, and b) general questions relating to the system of higher education, selected structural aspects of research and teaching as well as the strategic planning and assessment of specific fields and disciplines. It issues reports with recommendations on academic and research topics like, "Funding of Large-scale Facilities of Scientific Basic Research" (2002).

An important role in the country's research policy is also played by the Federal Parliament (*Bundestag*) though the Committee on Education, Research and Technology Assessment, (*Ausschuss für Ausbildung, Forschung und Technologie-Einschätzung*). This is a body drafting decisions in the field of education and research. At the same time, the Committee acts as an instrument of parliamentary scrutiny of the government's activities in those areas of policy. The corresponding ministry on the side of the federal government is the BMBF. The Committee's work centres on the regulation and promotion of vocational training, higher education, further training and financial assistance for students. In the field of research policy, the Committee deals with support

for research and technology in a wide variety of fields, e.g. environmental research, space flight and information and telecommunication technology.

In addition, there are 52 federal institutions performing research functions (*Ressort-Forschung*) (see Figure, Federal R&D institutions). These institutions perform their R&D functions in the framework of their governmental duties. The various activities are assigned to the federal ministries into whose portfolios they fall. The objective of their research activities is, therefore, first and foremost to obtain scientific findings that will help to perform departmental duties ("departmental or mission-oriented research"); however, they also help to acquire general knowledge. Furthermore, there are 84 Länder and municipal research institutions which are fully financed with Länder funds.



Funding flow for university and extra-university research. . Acronyms are: BLK= *Bund-Länder-Kommission*, DFG = *Deutsche Forschungsgemeinschaft*, HGF = *Helmholtz-Gemeinschaft Deutscher Forschungszentren*, FhG = *Fraunhofer-Gesellschaft*, MPG = *Max-Planck-Gesellschaft*, WGL = *Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz*

A peculiarity of the German research system is the concept of "Foundation". Institutions of this type are not government institutions. Some are funded by federal and/or Länder governments (e.g. Alexander von Humboldt Foundation). In these foundations, the governments' research policy interests are safeguarded by representatives in the governing boards. Others are non-profit foundations under private law (e.g. Volkswagen Foundation).

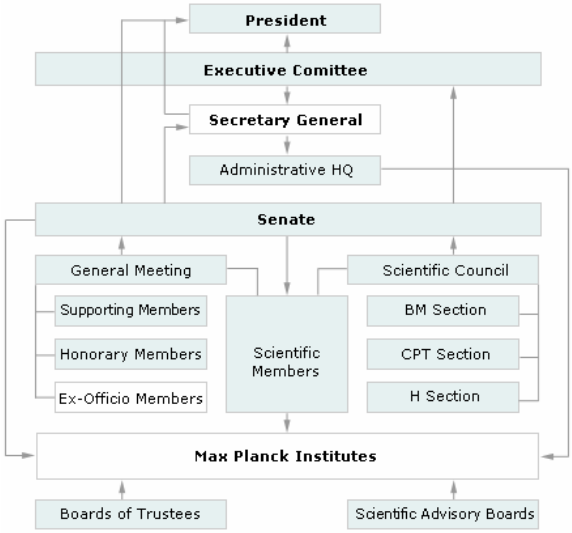
3.1 The Players in German Astronomy and Astrophysics

3.1.1 The Max Planck Society

The Max Planck Society for the Advancement of Science (*Max Planck Gesellschaft*) (MPG) is an independent, non-profit research organisation. It was founded on February 26, 1948, and it's the successor organisation to the Kaiser Wilhelm Society, which was established in 1911. The research institutes of the Max Planck Society perform basic research in the interest of the general public in natural sciences, life sciences, social sciences, and the humanities. The variety of topics in the natural sciences and the humanities at Max Planck Institutes complement the work done at universities and other research facilities in forefront leading research fields. In certain areas, the institutes occupy key positions, while other institutes complement ongoing research. Moreover, some institutes perform service functions for research performed at universities by providing equipment and facilities to a wide range of scientists, such as telescopes, large-scale equipments, specialized libraries, and documentary resources.

MPG has its own budget, which is directly given by the BMBF and the Länder to the main MPG society (50:50 financing shares, see below), and the institutes compete for funding. Funds are allocated directly to the directors of the Max-Planck Institutes who are responsible for their use.

Individual governing bodies within the Society make the decisions required to ensure that the Max Planck Society functions efficiently as a large research organisation.



The General Meeting

Members of the Max Planck Society convene in the General Meeting, the principle governing body. During this meeting, decisions are made on the amendments to the Society's statutes, and members are elected to the senate.

The Senate

The Senate is the central decision-making and supervisory body. Senate members are chosen from important areas in society and science and are, thus, able to support research policy decisions with a broad background. Some of them are ex-officio members of the Senate, while others are elected during the General Meeting.

The Senate decides on the establishment or closure of institutes, on the appointments of scientific members and institute directors, as well as on the budget. The Senate elects the President for a six-year term and members of the Executive Committee, and also appoints the Secretary General. Thus, the Senate has the most important capacities regarding research policy.

The Executive Committee

The Executive Committee advises the President and prepares important decisions. The Executive Committee and the Secretary General comprise the Board of the Max Planck Society.

The Presidency

The President represents the Max Planck Society, sets guidelines for research policies and presides over the Senate, the Executive Committee, and the General Meeting. In matters requiring immediate attention, the President is empowered to make decisions that would normally fall within the authority of the above-mentioned bodies.

The Sections

The Sections prepare decisions of the Society that require specific scientific competence and prepare recommendations regarding the appointment of Scientific Members as well as the establishment or closure of institutes and departments. Together, the Sections comprise the Scientific Council of the Max Planck Society.

MPG & Astrophysics

The eighty institutes and research facilities of the Max Planck Society are divided into three Sections: the Chemistry, Physics and Technology Section, the Biology and Medicine Section, and the Humanities Section. Among the institutes acting in the Physics and Technology Section there are 8 different Research Institutes active in astronomical research, (see table on the left).

MAX PLANCK INSTITUTES IN THE ASTRONOMY DOMAIN

MPI für Astronomie, Heidelberg MPI for Astronomy
MPI für Astrophysik, , Garching MPI for Astrophysics
MPI für Gravitationsphysik (Albert-Einstein-Institut), Potsdam, Hannover MPI for Gravitational Physics "Albert Einstein"
MPI für Extraterrestrische Physik, , Garching MPI for Extraterrestrial Physics
MPI für Kernphysik, Heidelberg MPI for Nuclear Physics
MPI für Physik (Werner-Heisenberg-Insitutu), München MPI for Physics "Werner-Heisenberg-Institut"
MPI für Radioastronomie, Bonn MPI for Radio Astronomy
MPI für Sonnensystemforschung, Katlenburg-Lindau MPI for Solar System Research

3.1.2 The Leibniz Association

The Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz e.V. (WGL) is a scientific organisation comprised of 84 non-university research institutes and service facilities. The research work carried out and services provided are of national significance. For this reason, the institutes' work is funded by both the federal government and the Länder (50:50 proportion). The Leibniz Institutes are demand-oriented and interdisciplinary centres of competence.

The umbrella organisation coordinates the mutual interests of the associated institutes, representing them in public. It strengthens scientific co-operation, promotes up-and-coming academics and is responsible for the development of a comprehensive system of quality management. In a unique process, every institute is assessed externally at regular intervals by independent experts.

Presidency

The Presidency (presiding board) consists of the vice-president and the speakers of the Sections, the Administrative Board and the Inter-disciplinary Association of Service Institutions. The managing director participates with advisory voice in the meetings of the Presidency. It co-ordinates all substantial affairs of the Leibniz Association, prepares important decisions and advises the president.

Senate

The senior advisory board is the Senate, which was set up in 1998 and whose members include representatives of state and federal administrations, presidents and chairpersons of leading academic organisations, leading external academics and executives from industry, trade unions and the European Commission.

The Senate administrates science-political concerns of the Leibniz Association and performs consulting tasks. It provides recommendations regarding the strategic advancement of the association and its members as well as regarding the increase of the efficiency and competitive ability of research and services for the research. The Senate develops criteria and procedures for quality assurance and efficiency of the Leibniz Institutes.

For the preparation of his statements in the evaluation process, the Senate appointed the Senate Committee Evaluation (SAE). SAE Members are members of the Senate, federal and state representatives, as well as external scientists who are not executives of Leibniz facilities.

Sections and Inter-disciplinary Association of Service Institutions

Five Sections group the technical and science related interests of the Leibniz Institutes. They organize the exchange of ideas and experiences, swap notes, promote the up-and-coming academics and assist in the development of evaluation criteria and the evaluation itself. In addition to their work in the Sections, 18 service facilities for research are organized in the Inter-disciplinary Association of Service Institutions (IVS). The members of the Sections and the IVS elect a speaker, who is a member of the Presidency.

Administrative Board

The Administrative Board promotes the exchange of ideas and experiences in administrative affairs of the members as well as the development of statements and recommendations to the Presidency and the General Assembly. The committee discusses the draft budget and provides

recommendations. The Administrative Board appoints project teams, in order to work on questions to commercial, administrative, legal and financial topics. It deputizes a speaker or spokeswoman to the Presidency, nominates candidates for the administrative vice-president and the auditor. The Administrative Board is composed of the administrative directors of the Leibniz Institutes and meets usually twice a year.

Office

The headquarters is based in Bonn and an office in Berlin supports the committees and bodies of the Leibniz Association. It cultivates and establishes contacts to political and administrative institutions, is responsible for joint public relations and offers central services to all member institutes.

Institutes

Leibniz Institutes are grouped into five sections. They cover:

- Section A: humanities and education;
- Section B: economic and social sciences;
- Section C: life sciences;
- Section D: physical sciences;
- Section E: environmental research.

Inside Section D, there are two astronomy and astrophysics devoted institutes, the Astrophysiklaisches Institut Potsdam (AIP) and Kiepenheuer-Institut für Sonnenphysik (KIS).

Astrophysics Institute of Postdam

Astrophysikalisches Institut Potsdam

This is the only "pure" Astronomical Institute in the foundation and was inherited from the former East Germany. Most of the working funds for AIP are provided by the Lander, and limited funds for research.

Kiepenheuer-Institut für Sonnenphysik

Kiepenheuer-Institut für Sonnenphysik

The Kiepenheuer-Institut für Sonnenphysik conducts experimental and theoretical investigations of physical processes on and within the Sun. Its headquarter is located in Freiburg, Germany. It operates the "German Solar Research Facilities" on Tenerife.

3.1.3 The Helmholtz Foundation

The Helmholtz-Gemeinschaft Deutscher Forschungszentren (HGF) (Helmholtz Association) is a community of 15 scientific-technical and biological-medical research centres. These centres have been commissioned for pursuing long-term research goals on behalf of the state and society. The federal and Länder authorities share around 70% of the total budget in a ratio of 90:10. The remaining 30% or so of the budget is acquired by the Helmholtz Centres in the form of contract funding. The Association strives to gain insights and knowledge so that it can help to preserve and improve the foundations of human life. It does this by identifying and working on the grand challenges faced by society, science and industry. Helmholtz Centres perform top-class research in strategic programmes in six core fields: Energy, Earth and Environment, Health, Key Technologies, Structure of Matter, Transport and Space. Each Helmholtz Centre is largely independent and most of them are focused on the construction and management of internal programs, infrastructures and facilities.

In the field of astroparticle physics, there are research groups at two Helmholtz Centres, namely at the Deutsches Elektronen-Synchrotron DESY in Hamburg and at the Forschungszentrum Karlsruhe (FZK). In the field of planetary science, there is one Helmholtz Centre, the Institut für Planetenforschung which is part of Deutsches Zentrum für Luft- und Raumfahrt (DLR), located in Berlin-Adlershof.

3.1.4 Deutsches Zentrum für Luft- und Raumfahrt

The German Aerospace Center (DLR) is Germany's national research centre for aeronautics and space. Its extensive research and development work is integrated into national and international cooperative ventures. As Germany's space agency, the DLR acts on behalf of the German federal government for the forward planning and implementation of the German space programme as well as international representation of Germany's interests.

The DLR is organised as a chartered non-profit organisation. The constitutional organs are *General Assembly, Senate, Space Committee, Executive Board* and *Scientific-Technical Advisory Council*. The DLR Executive Board has five members.

The DLR consists of three sub-units: a) the DLR R&D institutes, which are members of the Helmholtz Association (e.g. in Berlin-Adlershof), b) the Space Agency and c) the Project Management branch. The organigram shown below contains the Space Agency and Project Management. The latter is not active in astrophysics.

Among other activities not related to astrophysics, the Space Agency of DLR is responsible for managing the national space activities on behalf and in accordance with the requirements of the Federal Ministry for Economics and Technology (BMWi). The agency implements the German space programme, which was adopted by the government in May 2001. It is responsible for the development of Astronautics and Space Science activities. It also manages the German membership to ESA (see below).

It performs its activities on an independent strategic planning by a programme commission for space science with representatives also from science. There are programme boards for extraterrestrial science, earth observation, etc. as well as a referee board for the evaluation of project proposals.

The German space programme includes Germany's participation in European Space Agency (ESA) programmes, the country's national programme and DLR's internal Research & Development programme. Overall management of Germany's space activities includes implementing and updating all programme content in line with budgetary developments.

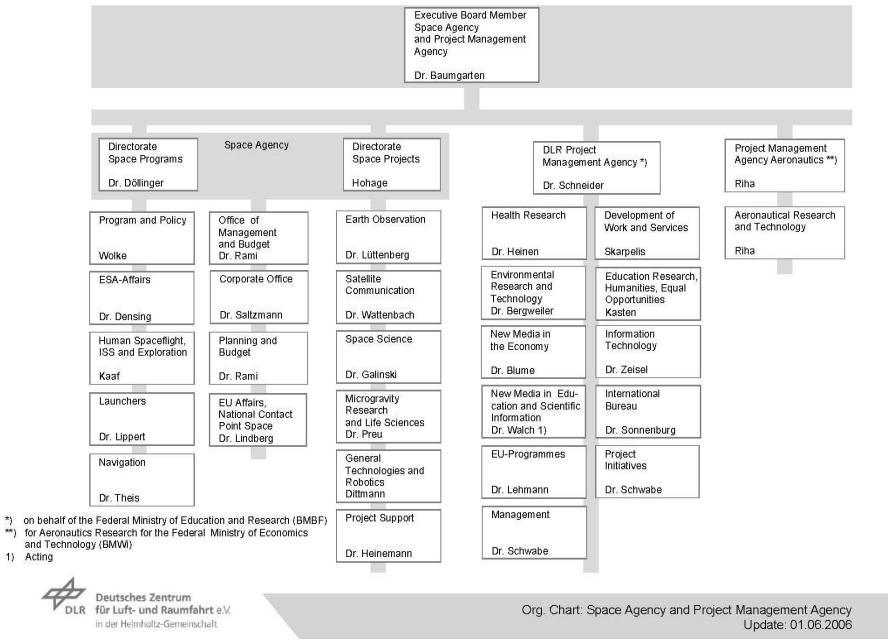
Space activity management includes planning and implementing projects financed under the national programme, as well as key DLR research projects. The process of calling for proposals, awarding contracts and coordinating all projects in the national programme also comes under the Agency's sphere of responsibility.

Another core management task is to enhance Germany's position and formulate negotiation strategy for all relevant ESA committees. This process takes into account all political, strategic, programme-related, industrial policy and financial aspects - and then consistently, uniformly and, thus, efficiently incorporates and represents them in all ESA committees.

Space Agency activities focus on the following fields:

- Earth observation
- Navigation
- Communication
- Space science

- Microgravity research
- Space transportation
- International Space Station (ISS) and Manned Space Flight
- Space technology



3.1.5 The Universities

There are 19 universities with departments active in astronomy and astrophysics. They are listed in the table below. Note that the International University Bremen (IUB) is a private university.

Universities with Astronomy and Astrophysics Working Groups or Departments

University	Department
Technische Universität Berlin	Zentrum für Astronomie und Astrophysik
Universität Bochum	Astronomisches Institut
Universität Bochum	Theoretische Weltraum- und Astrophysik - Lehrstuhl IV
Universität Bonn	Argelander-Institut für Astronomie - Astrophysik
Universität Bonn	Argelander-Institut für Astronomie Radioastronomie
Universität Bonn	Argelander-Institut für Astronomie Sternwarte
Technische Universität Dresden	Institut für Planetare Geodäsie
Universität Erlangen-Nürnberg	Dr. Remeis–Sternwarte Bamberg
Universität Frankfurt	Institut für Theoretische Physik
Universität Göttingen	Institut für Astrophysik
Universität Hamburg	Hamburger Sternwarte
Universität Hannover	Institut für Gravitationsphysik
Universität Heidelberg	ZAH, Astronomisches Recheninstitut
Universität Heidelberg	ZAH, Institut für Theoretische Astrophysik
Universität Heidelberg	ZAH, Landessternwarte Heidelberg-Königstuhl
Universität Jena	Astrophysikalisches Institut und Universitätssternwarte
Universität zu Kiel	Institut für Theoretische Physik und Astrophysik - Abteilung Astrophysik
Universität zu Köln	I. Physikalisches Institut
Ludwig-Maximilians-Universität München	Universitätssternwarte München
Technische Universität München	Physik Department E 15
Universität Potsdam	Lehrstuhl für Astrophysik
Universität Tübingen	Institut für Astronomie und Astrophysik, Abt. Astronomie
Universität Tübingen	Institut für Astronomie und Astrophysik, theoret. Astrophysik & Computational Physics
Universität Würzburg	Lehrstuhl für Astronomie
International University Bremen	School of Engineering & Science - Geosciences & Astrophysics

3.1.6 Observatories

Thüringer Landessternwarte
'Karl Schwarzschild' Tautenburg

The observatory was founded in 1960 as an affiliated institute of the former German Academy of Sciences (East Berlin) and named "Karl-Schwarzschild-Observatorium" in honour of the famous astronomer and physicist Karl Schwarzschild (1873 - 1916).
In 1992, the institute was renamed as "Thüringer Landessternwarte 'Karl Schwarzschild' Tautenburg" indicating that it is operated and funded as a State Observatory of the Freistaat Thüringen.

3.1.7 RDS Rat Deutscher Sternwarten

The *Rat Deutscher Sternwarten* (RDS) (Council of German Observatories) acts on behalf of all German astronomical institutes with respect to funding agencies, governments and international organisations. At present it has 36 member institutes.

3.1.8 KAT - Komitee für Astroteilchenphysik

The *Komitee für Astroteilchenphysik* (KAT) (Committee for Astroparticle Physics) is a self-organized committee of researchers in the field of astroparticle physics. The Committee defines and formulates the goals of the community of German astroparticle physicists in close contact with the community.

3.2 The German Astronomy @ Main European Organisations

3.2.1 The ESA membership

The funding for the German membership to ESA is financed by the BMWi and the Federal Ministry of Traffic, Construction and City Development (BMBVS) and is managed by the DLR. The German representation at the ESA decisional boards are shown in the following table:

@ ESA Boards	
ESA BOARD NAME	**APPOINTING INSTITUTION**
Ministerial Level Council	BMWi
Council:	DLR
SPC	DLR

3.2.2 The ESO membership

The funding for the German membership at ESO is directly provided by the Ministry of Education and Research (*BMBF)*. The German representation at the ESO decisional board is shown in the following table:

@ ESO Council	
POSITION	**APPOINTING INSTITUTION**
Political Member	BMBF - Bundes Ministerium für Bildung und Forschung
Scientific Member	BMBF - Bundes Ministerium für Bildung und Forschung

3.3 The Funding

The German research funding system is based on the activity of independent agencies that manage funds for scientific activities.
Science is funded through two channels, the institutional funding and funding programmes owned by different funding agencies.

The institutional funding

The funding of national research system is guaranteed jointly by the federal government and the Länder through the institutional funding. This includes the construction and operation of large research facilities.

The MPG is jointly funded by the federal government and the Länder with shares of 50% and 50%, respectively. Likewise, HGF and WGL are funded with shares of 90% and 10%, and of 50% and 50%, respectively (see Figure 4).

The programme funding

Science funding through funding programmes in astrophysics and astroparticle physics is run by various funding agencies both governmental and non-governmental ("Projektförderung").

3.3.1

Bundesministerium für Bildung und Forschung

BMBF

As the largest single research funding agency, the BMBF supports research by funding basic research and the respective organisations, key technologies, and prevention research, jointly with the Länder. It also fosters young researchers and international exchange. Due to constitutional constraints, project funding by the BMBF has the pre-condition of a superior federal interest which justifies federal funding. Typically, in the field of astronomy this is the case for large international infrastructures with a major financial contribution by the BMBF.

The BMBF's support for scientific basic research is focused on topics which are specific to large-scale research and are of supra-regional, international or fundamental significance. The focus of BMBF support is on physics, astrophysics and astronomy as well as on selected research topics requiring special large-scale equipments including astrophysics and astroparticle physics. The co-action of research groups and national or international large facilities is supported through the funding scheme called "Projektförderung". Funding is available primarily for universities in order to enable research by university groups using large facilities. Research

institutes like Max Planck Institutes and Helmholtz Centres are eligible for this funding scheme but, only with strong restrictions.

BMBF issues strategic guidelines for the usage of these funds (e.g. support for VLT instruments). For the funding period 2005-2008, it allocated 3.5 M€/year for astroparticle physics and 3.0 M€/year for astrophysics. BMBF funds are granted as three year contracts. Calls are open every three years.

PT-DESY

PT-DESY (*Projektträger DESY*) acts on behalf of BMBF and is authorised by the BMBF to implement the call on the administrational level. It is dedicated to the funding of astrophysical and astroparticle research programs related to ground-based large facilities which forms one joint funding programme section. High energy physics and condensed matter are run by other programme PT-DESY sections.

The call process typically starts around mid-year with a Workshop with participants from the scientific community where the basic strategic indications are discussed. Typically the call is issued in September, with a deadline for the end of December. Final decisions must be taken within 6 months from the deadline, and funds are available from July 1. The proposals are evaluated by a scientific board nominated by the BMBF. Each proposal is first evaluated by two members of the board and then, all proposals are discussed by the panels. Each project, typically, does not receive more than 1/10 of the available budget. Average size is 300k€ per 3 year period.

3.3.2 The Deutsche Forschungsgemeinschaft

The Deutsche Forschungsgemeinschaft (DFG) (German Research Foundation) is the central, self-governing research funding organisation that promotes research at universities and other publicly financed research institutions in Germany. The DFG serves all branches of science and the humanities by funding research projects and facilitating cooperation among researchers. Funds are dedicated to individual or coordinated research programs, but not to infrastructures. The main evaluation criterion is scientific excellence, with no a priori allocation planning to the different disciplines or the strategic guidelines. DFG issues a wide variety of funds, ranging from small programs for single scientists to large programs among several coordinated institutions. There is no deadline for submitting individual grants.

The budget of the DFG is jointly financed by the federal government and the Länder with shares of 58% and 42%, respectively.

The statutory bodies:

- General Assembly
- Executive Committee
- Senate
- Joint Committee
- Review Boards
- Excellence Initiative Grants Committee
- Grants Committee on Collaborative Research Centres
- Grants Committee on Research Training Groups
- Selection Committee for the Heinz Maier-Leibnitz Prize
- Ombudsman of the German Research Foundation
- DFG Liaison Officers

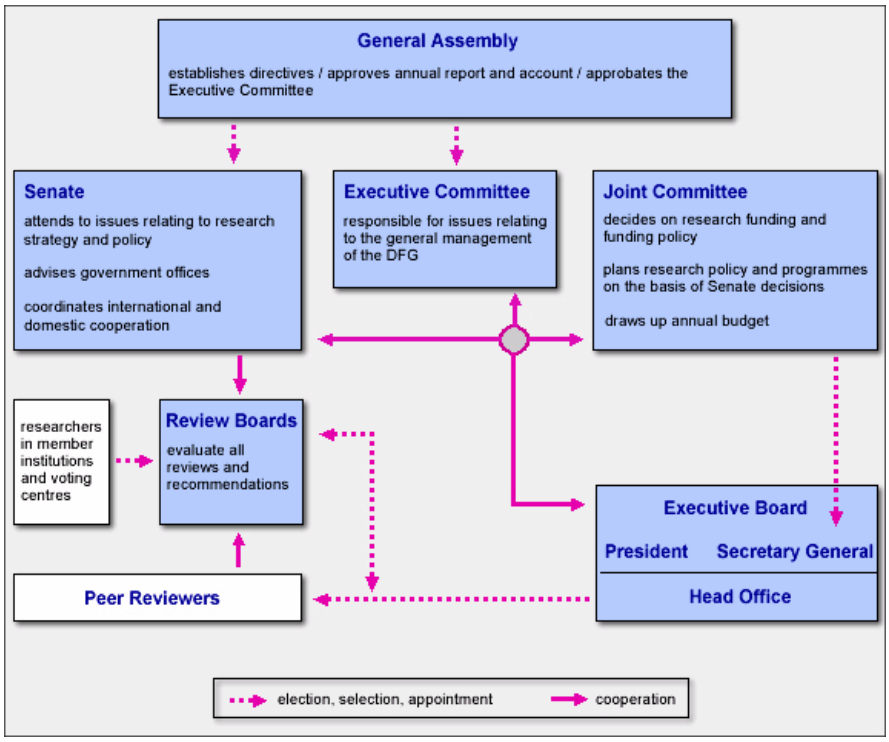
The General Assembly

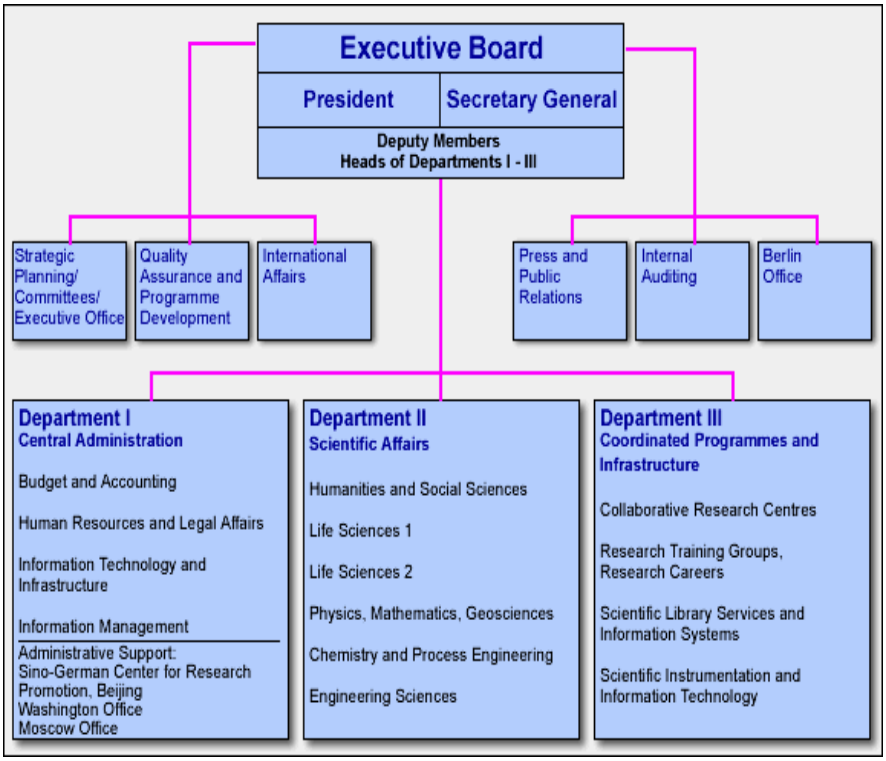
is responsible for decisions on basic principles; this is the only body that is entitled to amend the statutes and with that, the responsibilities and mission of the DFG.

The Executive Board

is made up of the President and the Secretary General. The Executive Board represents the DFG in and out of court. The Directors of Departments I - III serve as deputy board members.

The other statutory bodies of the DFG - the Executive Committee, Senate, Joint Committee and Review Boards - each represent a specific aspect of the research support to which the DFG is committed.


General Assembly
establishes directives / approves annual report and account / approbates the Executive Committee
Senate
attends to issues relating to research strategy and policy
advises government offices
coordinates international and domestic cooperation
Executive Committee
responsible for issues relating to the general management of the DFG
Joint Committee
decides on research funding and funding policy
plans research policy and programmes on the basis of Senate decisions
draws up annual budget
researchers in member institutions and voting centres
Review Boards
evaluate all reviews and recommendations
Executive Board
President
Secretary General
Head Office
Peer Reviewers
election, selection, appointment
cooperation


Executive Board
President
Secretary General
Deputy Members
Heads of Departments I - III
Strategic Planning/ Committees/ Executive Office
Quality Assurance and Programme Development
International Affairs
Press and Public Relations
Internal Auditing
Berlin Office
Department I
Central Administration
Budget and Accounting
Human Resources and Legal Affairs
Information Technology and Infrastructure
Information Management
Administrative Support:
Sino-German Center for Research Promotion, Beijing
Washington Office
Moscow Office
Department II
Scientific Affairs
Humanities and Social Sciences
Life Sciences 1
Life Sciences 2
Physics, Mathematics, Geosciences
Chemistry and Process Engineering
Engineering Sciences
Department III
Coordinated Programmes and Infrastructure
Collaborative Research Centres
Research Training Groups, Research Careers
Scientific Library Services and Information Systems
Scientific Instrumentation and Information Technology

3.3.3 Deutsches Zentrum für Luft- und Raumfahrt

Main task of DLR is to implement the national space programme via its Space Agency branch. This is accomplished by funding science projects at Max-Planck institutes, universities, WGL institutes and also by industry contracts with a budget of about 30 M€ per year. This includes funding of scientific usage of data from space missions, with a typical amount of 1.3 M€/year. Funding includes the development and construction of components, in particular scientific instruments, and even of entire satellites. This task is performed partly in conjunction and task sharing with ESA, which is responsible for the satellite bus, launch, and mission control; whereas, the participating national agencies provide the scientific instruments. Apart from ESA, DLR cooperates with NASA (e.g. SOFIA, Chandra), CNES (e.g. Corot, Microscope) and other agencies; rarely performing purely national projects.

3.3.4 The Länder

The Länder funds basic research at universities and on specific scientific projects. They also co-fund research institutions together with the federal government.

3.3.5 Private funds

The Volkswagen Foundation has been funding research projects in all disciplines since 1962. Despite its name, the Volkswagen Foundation is not a subsidiary of the respective company, but an independent, non-profit Foundation under private law. It is the largest private science funding agency and one of the major foundations in Germany. Although, there is no specific astrophysics funding programme, projects in astronomy and astrophysics can be funded as part of natural sciences. For example, the Volkswagen Foundation has contributed to HET and SALT.

3.3.6 Other funds

Grants for exchange of personnel from or to foreign countries are provided by the Alexander von Humboldt Foundation and by the German Academic Exchange Service (DAAD).

The Alexander von Humboldt Foundation is a non-profit foundation established by the Federal Republic of Germany for the promotion of international research cooperation. It enables highly qualified scholars not residing in Germany to spend extended periods of research in Germany as Humboldt Fellows and promotes the ensuing academic contacts. German researchers can use a Feodor-Lynen Fellowship granted by the Humboldt Foundation to go abroad and work at the home institute of a former Humboldt Fellow, normally for two years.

The DAAD is a joint institution of German universities fostering international relations ranging from short-term research or teaching exchange to doctoral scholarships for (post) graduates from developing countries which last several years, and from information visits by delegations of foreign university rectors and vice-chancellors to the long-term regional programme which aims to create efficient higher education systems in the Third World.

Funding Summary*

Funding	Body	M€/year (2000)
	DFG	9
	BMBF (ESO)	22
	BMBF (national)	11[1),4)]
	Länder	58[2),4)]
	DLR (ESA)	50
	DLR (national)	16[5)]
	MPG (institutional)	60[3),4)]
	Total	226

*source:DFG Denkschrift "Status und Perspektiven der Astronomie in Deutschland 2003-2016", 2003

[1)]incl. institutional funding of WGL and project funding (ca. 3 M€), [2)]incl. institutional funding of Universities and *Länder* institutes;[3)]continuous additional support programmes for astronomy granted by the MPG are not included. The total budget of the MPG in 2006 is ca. 106 M€; [4)]total institutional funding ca. 110 M€ (2000); [5)]budget for astronomy, total budget for the national extraterrestrial research programme 37M€/year in 2000 (30 M€/year in 2006).

Global Amount of Funds Devoted to Astronomy in 2000 (source: DFG Denkschrift "Status und Perspektiven der Astronomie in Deutschland 2003-2016", 2003)	*M€* *226,00*

3.4 The Personnel

The professional profiles of people enrolled in astronomy research are common to other disciplines due to the same nature of public bodies or universities.

Research staff positions in universities and research institutes include Full Professors/Research Managers, Associate Professors, Reseachers, and temporary positions partly financed by third party funds.

Junior professorships are temporary positions limited to 6 years. Some are tenure-track positions. As university positions, they are financed by the Länder. Most temporary positions are funded through programmes of the DFG, BMBF or DLR. A fraction of the established posts ("Planstellen"), which are permanently available and are financed through the core (institutional) funding of the respective institutions, are only temporarily and alternatively filled. For example, at MPIs about 50% of these positions are temporarily filled.

Presently, temporary positions for researchers at universities and research institutions are limited by law, applicable to universities and public research institutions, to a total of 12 years: comprising 6 years pre- and 6 years post-doctoral work contracts. This will be replaced in 2007 by new regulations in the course of the reform of the federal system. Most temporary positions are funded through programmes of the DFG, BMBF or DLR. Temporary contracts can also be issued on the basis of general employment laws..

Postdoc positions may be opened by universities and research institutes either with or without any direct link with specific projects, while other grants at the post or pre-doctoral level are typically associated to a specific project.

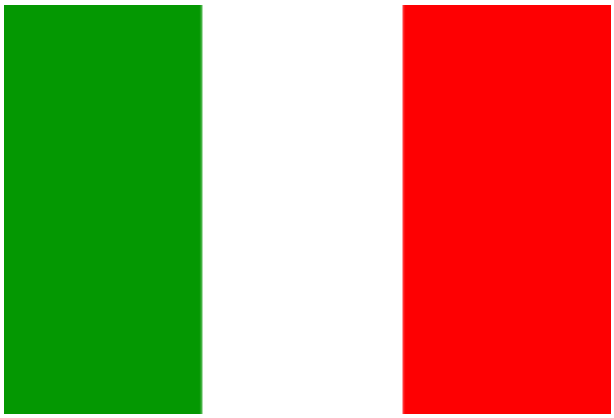
Ph.D. degrees are awarded by universities, which select students with a competitive evaluation procedure. Universities fund also associated grants, without any pre-defined allocation to research projects. Public bodies can also fund supplementary grants for Ph.D. students, either supplementing the number of grants without any pre-defined allocation to research projects or calling for an explicit link with specific projects.

The gross salaries of researchers at universities and public research institutes, no matter whether permanently or temporarily employed, are in the range between 2,800 and 5,000 € per month according to the salary scale for public service employees (approximately 62,000 € to 85,000 € per year total costs for employers). Details depend on various conditions, such as experience, age, etc.. Ph.D. positions are paid between 50% and 100% of a full researcher salary, normally at the lower salary limit, again depending on various conditions. Professors (all levels) are paid according to a different scale, with minimum basic salaries (per month) of about 3,400 € for Junior Professors,

3,900 € for Associate Professors, and 4,700 € for Full Professors. The effective salaries can be significantly higher; a general rule can, however, not be given.

Personnel*						
Role	Male	Female	Universities	Others	Total #	Age
Full professor	n/a	n/a	27	23	**50**	n/a
Associate professor	n/a	n/a	19	28	**47**	n/a
Permanently available positions (« Planstellen »)	n/a	n/a	95	281	**375**	n/a
Third party (DFG, DLR, BMBF) funded positions	n/a	n/a	83	119	**202**	n/a
Ph.D. positions, permanently available	n/a	n/a	31	116	**147**	n/a
P.hD. third party (DFG,DLR, BMBF) funded positions	n/a	n/a	215	47	**262**	n/a

(*source: DFG Denkschrift "Status und Perspektiven der Astronomie in Deutschland 2003-2016", 2003)



Chapter 4

The Management of Italian Astrophysics

An overview of the organisation of the research system in Italy

The Italian research activities are essentially public, and most of the funds for research infrastructures and universities are provided by the Italian State.

According to the prescriptions of the Law 9 May 1989, n.168 and successive decrees, the public scientific research is performed and managed by public bodies, institutes, universities and funding agencies. They, independently, carry out their scientific, managerial and accounting activities, but, follow the strategic guidelines of the government that supervise the activities.

In this scenario, the government still has an addressing, funding and supervising power on these public bodies, still playing a fundamental role in planning the research policy and allocating the funds.

The general specifications are indicated in a document, the 'Guidelines for Scientific Research and Technology of the Government', drawn up by the Council of Italian Ministers. National research policy and priorities are, generally, established in two strategic pluriannual documents described below.

PNR - *Programma Nazionale di Ricerca*

The *Programma Nazionale di Ricerca* (National Programme of Research) is a three-year national operational planning document for research activities drawn up by the Ministry of Education, University and Research (MUR) (see chart for details). It is based on the government policy on research and technology and to be approved by CIPE – *Comitato Inter-ministeriale per la Programmazione Economica* (Inter-Ministerial Committee for Economic Planning)

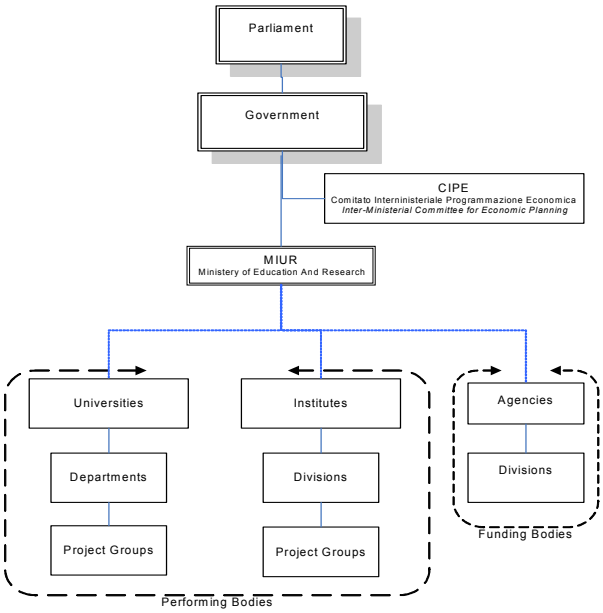
before becoming operative, since it also addresses the allocation of financial resources to support research projects. Currently, the PNR 2005-2007 is being implemented.

PON - *Piano Operativo Nazionale*

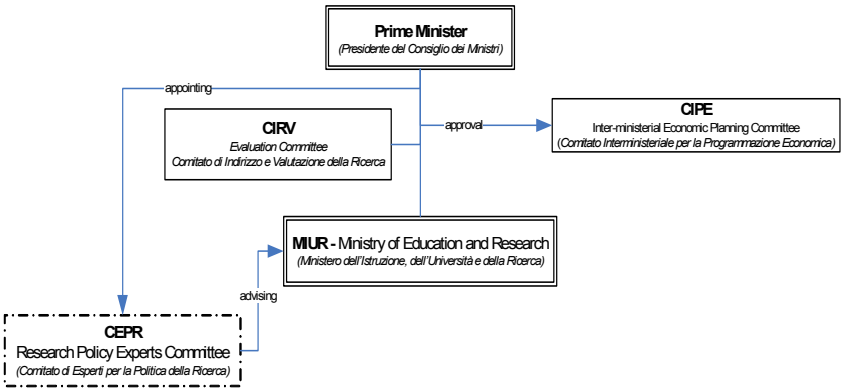
The *Piano Operativo Nazionale* (National Operational Plan) governs the national planning of the European funds, the so called Structural Funds. These are the European funds administered by the Italian public authorities to strengthen the research activities in some of the Italian regions.

Other ministries, such as the Ministry of Industry, the Ministry of Agricultural and Forestry Policies, the Ministry for the Environment and the Ministry of Health, develop research policies in their respective fields of activities. An important role in funding astronomy is played by the Ministry of Foreign Affairs.

The Italian government has also recently launched a policy of supporting the development of Technological Districts, the promotion of new Centres of Excellence and Scientific and Technology Parks.
In the next figures, the organisation chart of the national research system, and of the PNR are graphed.



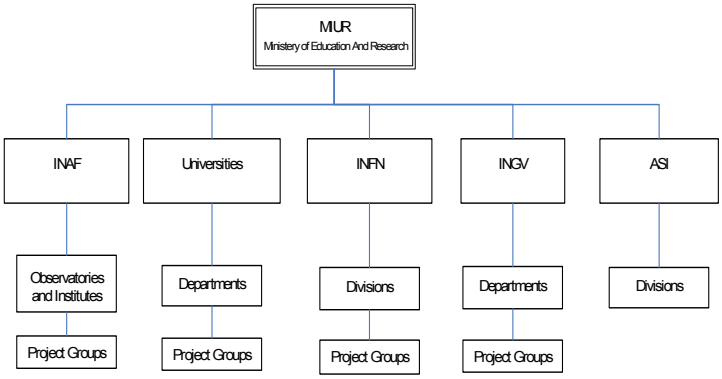
The Italian Research System



The National Research Plan is drawn up by the Ministry of Education and Research which can be supported, if needed, by the CEPR whose members are appointed by the Prime Minister.

4.1 The Players in Italian Astronomy and Astrophysics

Recently, the entire astronomy and astrophysics domain has been deeply revised through the creation of the **INAF** - *Istituto Nazionale di Astrofisica* (National Institute for Astrophysics) and the reorganisation of the **ASI** - *Agenzia Spaziale Italiana* (Italian Space Agency). In particular, INAF has been created by merging into a single body all the astronomical observatories as well as some of the research institutes, formerly, belonging to **CNR** - *Consiglio Nazionale delle Ricerche* (National Research Council). Departments of Astronomy or Physics of many universities are very active in astrophysical research, as well as institutes with different concerns as the **INFN** - *Istituto Nazionale di Fisica Nucleare* (National Institute for Nuclear Physics) and the **INGV** - *Istituto di Geofisica e Vulcanologia* (National Institute of Geophysics and Volcanology)



The main bodies involved in Astrophysics

4.1.1 Istituto Nazionale di Astrofisica

The Legislative Decree no. 296 of July 23, 1999 and the Decree no. 38 of June 2003 established the foundation of a new public body, the National Institute for Astrophysics (INAF), which links together all the structures that perform astronomy and astrophysics research, including the 12 astronomical and astrophysical observatories and three institutes, formerly, belonging to CNR.

The Law defines mission, activities, statutory bodies, organisational and functional principles and criteria with the purpose of promoting and linking operating structures of excellence, preventing duplication of similar institutional entities and guaranteeing the maximum level of flexibility, autonomy and effectiveness.

INAF research activities include the study of the Universe through astronomical observations and the experimental and theoretical understanding of the structure, composition and evolution of celestial objects. INAF is active in space and ground-based astronomy at any wavelength and in the study of cosmic rays and of gravitational waves. Its primary aims are:

- support of the basis research in astrophysics and astronomy;
- development of innovative technology for space and ground instruments;
- participation in international projects and realization of innovative facilities
- development and management of observational facilities (the main being TNG, a network of 12 small optical telescopes, three radio antennas and, in the near future, LBT and SRT)

INAF INSTITUTES

Institute	P	NP
Osservatorio Astronomico di Arcetri (Astrophysical Observatory of Arcetri)	42	33
Osservatorio Astronomico di Bologna (Astronomical Observatory of Bologna)	37	18
Osservatorio Astronomico di Brera (Astronomical Observatory of Brera)	31	17
Osservatorio Astronomico di Cagliari (Astronomical Observatory of Cagliari)	17	10
Osservatorio Astronomico di Capodimonte (Astronomical Observatory of Capodimonte)	31	24
Osservatorio Astronomico di Catania (Astrophysical Observatory of Catania)	27	11
IASF *Istituto di Fisica Cosmica e Fisica dello Spazio* (Institute of Cosmic Physics and Space Astrophysics – Bologna)	31	22
IASF *Istituto di Fisica Cosmica e Fisica dello Spazio* (Institute of Cosmic Physics and Space Astrophysics – Milan)	17	22
IASF *Istituto di Fisica Cosmica e Fisica dello Spazio* (Institute of Cosmic Physics and Space Astrophysics – Palermo)	16	5
IASF *Istituto di Fisica Cosmica e Fisica dello Spazio* (Institute of Cosmic Physics and Space Astrophysics – Rome)	37	30
IFSI *Istituto di Fisica dello Spazio Interplanetario* (Institute of Interplanetary Space Physics – Rome)	28	29
IFSI *Istituto di Fisica dello Spazio Interplanetario* (Institute of Interplanetary Space Physics – IFSI Turin)	12	3
IRA *Istituto di Radioastronomia* (Institute of Radio Astronomy - IRA Bologna) (Institute of Radio Astronomy - IRA Florence) (Institute of Radio Astronomy - IRA Noto)	42	19
Osservatorio Astronomico di Padova (Astronomical Observatory of Padova)	40	23
Osservatorio Astronomico di Palermo (Astronomical Observatory of Palermo)	13	11
Osservatorio Astronomico di Roma (Astronomical Observatory of Rome)	42	39
Osservatorio Astronomico di Teramo (Astronomical Observatory of Teramo)	7	9
Osservatorio Astronomico di Torino (Astronomical Observatory of Turin)	27	11
Osservatorio Astronomico di Trieste (Astronomical Observatory of Trieste)	34	20

- promotion of training and technical-professional advancement of Italian researchers through scholarships and research grants;
- public outreach

Today, more than 500 full-time astronomers work within INAF, among 20 different institutes and observatories.

INAF MAIN FACILITIES

TNG
Telescopio Nazionale Galileo
(Galileo National Telescope, La Palma – Canaries Islands)

LBT
Large Binocular Telescope, Arizona

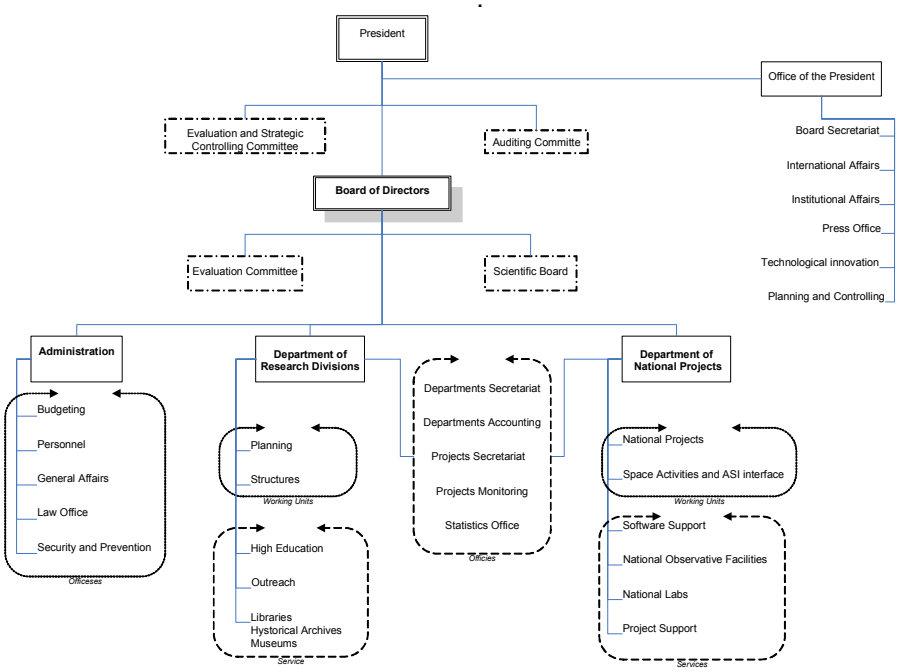
VLT
VLT Survey Telescope

REM
Rapid EYE Mount

THEMIS

The INAF Management

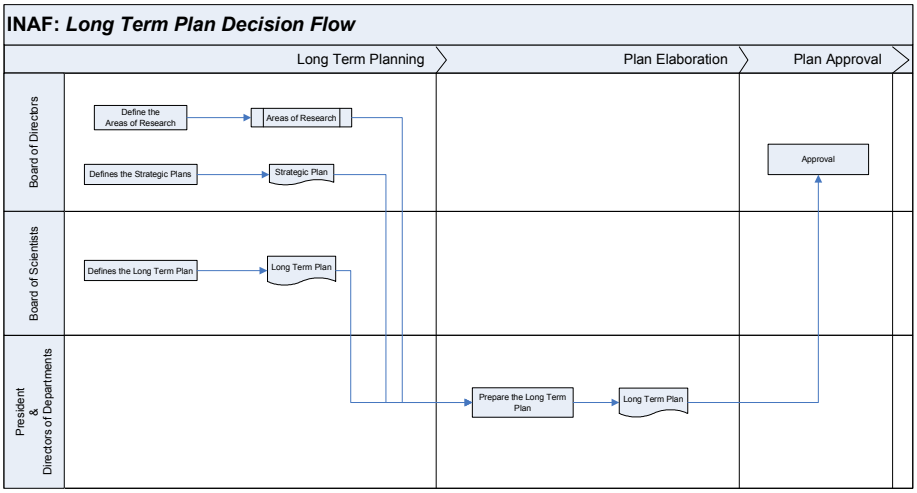
The current organisation of the Institute, as described in the chart shown below, envisons a governing board that consists of the President and the Board of Trustees, appointed by the government, *Consiglio dei Ministri* (Council of Ministers) on the recommendation of the *Ministro dell'Università e della Ricerca* (Minister of Education and Research). Their mandates last four years and can be renewed once.



INAF organisation chart

The Board of Trustees appoints the executive management, namely, the Directors of the departments and the Directors of the observatories and the institutes, subject to the approval of the Board of Directors.

The research activities are planned on the basis of the long-term scientific and strategic plans shown in the figure below.



4.1.2 Agenzia Spaziale Italiana

The Italian Space Agency has the goal of preparing and putting into effect the National Space Program that addresses the strategic choices of the country in the field of space research.

A primary goal of ASI is to fund the Italian participation to the ESA, of which Italy is the third country, in terms of the amount of financial contributions. In this context, ASI funds both the mandatory programs as well as the optional program. The ASI, also, has a strong tie of collaboration with NASA, for example, in the construction of the International Space Station, and participates in

ASI FACILITIES

Centro di Geodesia Spaziale "Giuseppe Colombo
(Giuseppe Colombo Space Geodesy Center)

I-PAF
Infrastruttura per il processamento, archiviazione e distribuzione di dati telerilevati da satellite
(The Italian Processing and Archiving Facility)

Base di Lancio "Luigi Broglio"
(Luigi Broglio Launch Pad for stratospheric balloons)

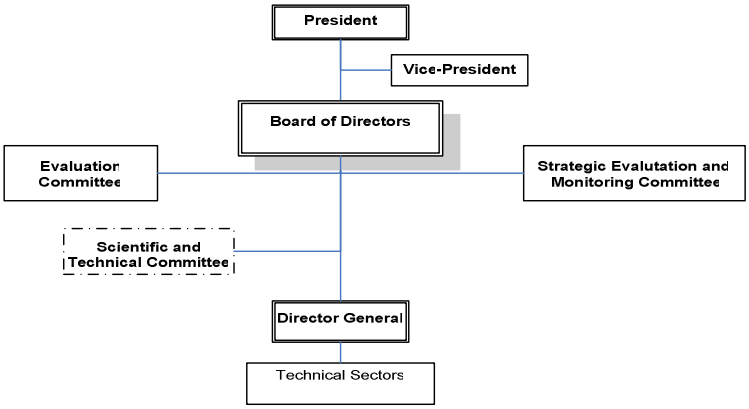
ASDC – ASI Science Data Center

many international programs, such as the exploration of Mars. In addition, ASI funds both astronomical and applied research in the field of astrophysics. The ASI executes the national space program by:

- projects planning
- funding research projects and missions through the science, technology and industry communities throughout the country.

The ASI Management

The Agency is led by a President and a Board of Directors appointed by the government and the mandate lasts four years and can be renewed only once. The general management of the Agency is described in the following figure.



The planning of astronomy activities is performed by the Unit "Observations of the Universe" of ASI, which is actually involved in several national and internationally shared programs.

4.1.3 The Universities

Universities in Italy provide teaching and research activities. In conformity with the principle of the autonomy of universities, each university draws up its own statutes and its own internal regulations.

Six Italian universities have Departments of Astronomy and/or Astrophysics in their Science Faculties, where many research groups in various fields are present. Many other Departments of Physics also have research groups in astronomy. Most universities award Ph.D. doctorates in astronomy and/or astrophysics.

The Universities Management

The universities' statutes establish the rules for its administration, teaching and research through:

Faculties

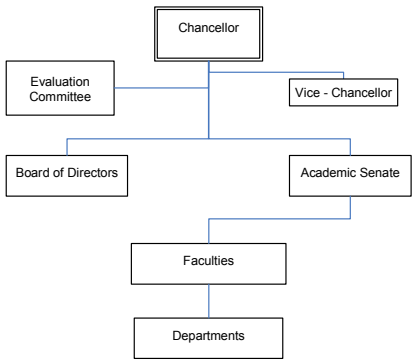
which co-ordinate the teaching of the various degree courses, appoint academic staff and decide their roles and activities. Faculties are administered by Faculty Councils and the Deans

Departments

which organise research in line with the teaching that is carried out, promote and manage research, organise Ph.D. courses and engage in research and consultancy activity outside the university. Departments are administered by Department Councils and the Directors

Institutes

which deal with the specific scientific sectors to which their teaching belongs and in which research is conducted. Institutes are administered by Councils and the Directors



Universities with Astronomy and Astrophysics Departments

University	Department
Università dell'Aquila	Physics
Università di Bologna	Astronomy
Università of Cagliari	Physics
Università of Calabria	Physics
Università of Catania	Physics and Astronomy
Università di Ferrara	Physics
Università degli Studi di Firenze	Astrophysics and Space Sciences
Università di Genova	Information Technology

Università di Lecce	Physics
Università di Messina	Physics
Università di Milano	Physics
Università del Molise	Earth and Environmental Sciences
Università di Milano "Bicocca"	"G. Occhialini" Physics Dept.
Università di Napoli "Federico Ii"	Physics
Università di Napoli "Parthenope"	Applied Sciences
Università degli Studi di Padova	Astronomy
Università di Palermo	Physical Sciences and Astronomy
Università di Parma	Earth Sciences
Università di Pavia	Physics
Università di Perugia	Physics
Università di Pescara-Chieti "D'annunzio'	IRSPC
Università di Pisa	Physics
Università di Roma "La Sapienza"	Physics
Politecnico di Milano	
Università di Roma "Tre"	Physics
Università di Roma "Tor Vergata"	Physics
Università di Salerno	Physics
Università di Teramo	Physics
SISSA	Astrophysics
Scuola Normale Superiore di Pisa	Physics
Università di Torino	Physics
Udine	Physics
Università della Tuscia	Physics

4.1.4 Istituto Nazionale di Fisica Nucleare

The National Institute of Nuclear Physics is traditionally devoted to research on nuclear and subnuclear studies, and performs experimental and theoretical activities in this field using its own facilities or international facilities such as CERN.

Within INFN, astroparticle physics has been attracting resources in these last years and INFN is investing many forces in this research domain, with a particular emphasis on high-energy astrophysics, cosmic rays, gravitational rays, cosmic microwave background and theoretical investigations of the early Universe.

Research activity at the INFN is carried out at two complementary types of facilities: the Divisions (Sezioni) and the National Laboratories. Each of the 19 Divisions are located at a university physics department. The Divisions, thus, provide a direct connection between the Institute and the academic world. The four Laboratories—in Catania, Frascati, Legnaro, and at Gran Sasso—are home to major facilities which are available to the national and international scientific community.

The INFN workforce includes about 2,000 of its own employees, almost 2,000 university employees involved in research conducted by the Institute, and 1,300 young researchers, including undergraduate and graduate students and research fellows. The organisation of the INFN represents an effective balance between centralized and decentralized management and is the product of customs established and strengthened over the years. The main decisional body of the Institute is the Council of Directors, comprised of the President and the Executive Board; the Directors of the four National Laboratories and 19 Divisions; and representatives from other institutions.

2.1.2 Istituto Nazionale di Geofisica e Vulcanologia

The INGV, National Institute Geophysics and Volcanology, is the national institute involved in the geophysical domain. The main research activity is on earthquakes and volcanology. It, in fact, is also incharge of the national earthquakes detection system and plays an important role through the activities of the Institute in the research on high atmospheric and solar phenomena and space weather.

4.2 The Italian Astronomy @ Main European Organisations

4.2.1 The ESA membership

The funding for the Italian membership to ESA is fully covered by ASI. The Italian representation at the ESA decisional boards are shown in the following table:

@ ESA Boards	
ESA BOARD NAME	**APPOINTING INSTITUTION**
Ministerial Level Council	Ministry of Education and Research
Council	President of the ASI
SPC	Members appointed by ASI

4.2.2 The ESO membership

The funding for the Italian membership at ESO is directly provided by the Ministry of Foreign Affairs (*Ministero degli Affari Esteri*). The Italian representation at the ESO decisional board is shown in the following table:

@ ESO Council	
POSITION	**APPOINTING INSTITUTION**
Political Member	Ministry of Foreign Affairs
Scientific Member	Ministry of Education and Research *

* The Ministry appoints the Scientific Member after an informal consultation with the Astronomical community through INAF.

4.3 The Funding

The Italian research public funding system is based on these main guidelines:

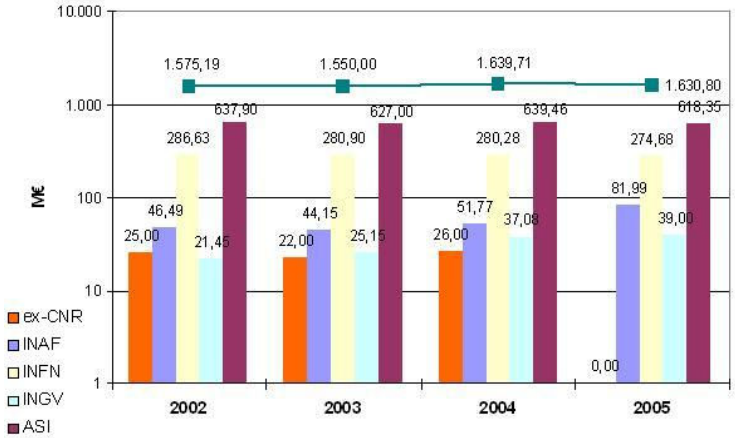
- governmental funds are provided without any pre-defined destination, allocated directly to the public bodies (such as INAF, ASI or INFN), to be used for both structures maintenance (personnel, buildings, etc…) and for funding research projects;
- targeted funds are provided to support projects in specific research areas on a competitive basis, according to the guidelines of the PRN - *Programma di Ricerca Nazionale* (National Research Program);
- EU funds;
- regional and local funds.

The first type of funds, often called FFO – *Fondo di Funzionamento Ordinario* (Ordinary Working Fund) is of competence of the Ministry of Education and Research while the others are allocated by the proposing ministries.

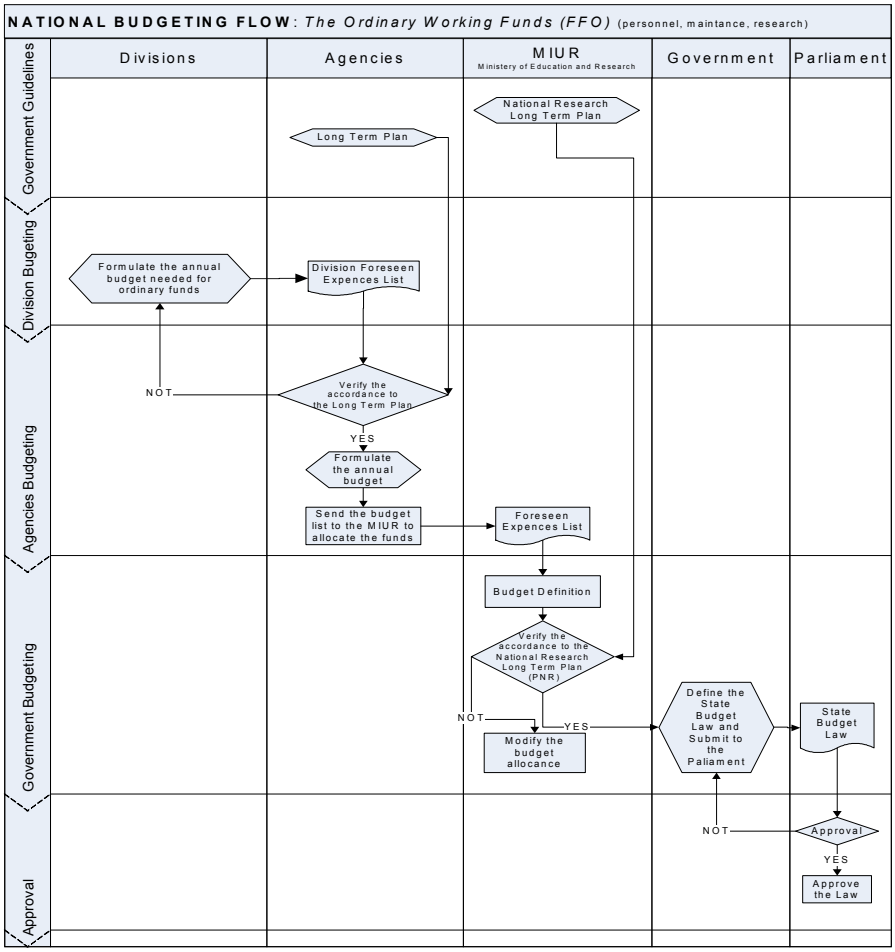
The core funding

The FFO is the core of the national research funding: it guarantees the basic working operations of the research institutes and support for the research. Unfortunately, the percentage devoted to research has kept decreasing over the last years.

The process of reaching the definition of the amount of money to allocate on this fund is a result of a bottom-up consultation process that takes into account the foreseen expenses of the institutes and the universities.



FFO Distribution. Note that in 2005 three institutes (ex-CNR) where merged into INAF. The green line shows the total amount of funds for all the national research bodies under the authority of the Ministry, that are more than the ones shown in the chart



4.3.1 Ministero dell'Università e della Ricerca

The Ministry of Education and Research is the major funding body in the Italian research system. Currently, it allocates integrative funds through targeted competitive calls open to all in the community. In the following table is shown the different types of calls performed by the Ministry.

Ministry of University and Research		
Fund Name	**Objectives**	**Amount**
PRIN ***Progetti di Rilevante Interesse Nazionale*** (Projects of Relevant National Interest)	The PRIN programme is the principal fund for projects of academic research. Every year the MUR co-finances research projects of relevant national interest proposed by universities and public bodies. They have a duration of one year or two years. The applications for co-funding of the PRIN projects presented to the MUR must be in line with precise scientific subjects that are freely chosen but deal with previously established topics. This makes the PRIN the fundamental instrument for the funding of the basic research of universities.	**2.6**
FIRB ***Fondo Integrativo Ricerca di Base*** (Supplementary Fund for Basic Research)	The fund supports defined basic research activities with activities that aim at a broadening of scientific and technical knowledge that is not connected with specific and immediate industrial or commercial objectives. • Projects for the strengthening of the major research infrastructures. • Basic research projects proposed by bodies and universities. • Strategic development projects involving pervasive and multi-sectorial technologies. • The creation of highly qualified scientific centres.	**2.0**
FISR ***Fondo Integrativo Speciale Ricerca*** (Special Supplementary Fund for Research)	Fund for financing of specific measures of special strategic relevance. The FISR co-finances up to a maximum of 70% of the total budgets of projects presented on subjects connected with the National Research Programme (PNR).	**n/a**
FAR *Fondo Iniziative di Ricerca* (Fund for Research Incentives)	The FAR programme co-finances projects of activities involving applied research (industrial research and innovation) on specific subjects. The project must be marked by a strong involvement of ICT and new technological processes, in particular for industries or networks of small or medium-sized businesses. The indicators for the assessment of projects are: • Consistency with the subjects given. • The degree and form of involvement of ICT companies. • The originality and innovation of the final product developed. • The quality and suitability of the research structures. • The reliability of the economic-employment consequences of the project.	**n/a**

Ministero dello Sviluppo Economico

The Ministry of Economical Development provides funding towards research that may have a technological spin-off.
The following table shows the current available funds.

Ministry of Economical Development		
Fund Name	**Objectives**	**Amount**
FIT *Fondo Iniziative Tecnologiche* (Rotating Fund for Technological Innovation)	Programmes to encourage pre-competitive development activities (that is to say the planning, experimentation with, development and pre-industrialisation of new products, and thus the implementation of pilot projects or prototypes), which can also include activity that is not preponderantly to do with industrial research or activity to foster the creation, broadening, modernisation, restructuring, conversion, reactivation, acquisition, or relocation of research centres, can receive these incentives.	**n/a**
FSSRIS *Fondo Speciale per lo Sviluppo della Ricerca d'Interesse Strategico* (Special Fund for the Development of Research of Strategic Interest)	Programmes to encourage development R&D in industrial strategic area	**n/a**

4.3.2 Istituto Nazionale di Astrofisica

Within the INAF budget, a fraction of less than 10% is devoted to the funding of research projects. In 2005, part of this research budget has been allocated directly to the Directors of each observatory and institutes to fund small-sized projects. Another part has been allocated to a nation-wide competitive call for projects, open also to researchers from universities and other bodies.
A third part has been dedicated to funding postdoc positions, with no pre-defined allocation to research projects. Finally, another part has been assigned to maintain and develop large projects and national infrastructures, selected according to the following evaluation flow.

INAF Funding (2005)		
Running cost + salaries	Infrastructures	Research Grants
77.5	6.4	4.5

4.3.3 Agenzia Spaziale Italiana

At variance with INAF, ASI devotes most of its budget to fund specific projects in all sectors of space science and technology. Currently, ASI does

not issue any open calls on a competitive basis, but directly assigns funds for specific projects, selected according to its strategic plan

4.3.4 EU funds

Membership to EU calls as the FPs are performed by single institutes and agencies or joint-ventures between them.

ASI Funding for Astrophysics Research (2005)	
Astrophysical domain	**M €**
High-Energy Astrophysics	18,039
Cosmology and Fundamental Physics	6,780
Solar System Exploration	10,439
Total	***35,258***

Structural Funds

The EU structural funds are partially administrated by the Italian government through the PON - *Programma Operativo Nazionale* (National Operational Programme), drawn up by the MUR to allocate the funds and plan the projects. The remaining part of the funds are administrated by local governments through the POR – *Piano Operativo Regionale* (Regional Operative Plan)

The PON envisions a quota of national co-financing and is intended for the Objective 1 Regions: Basilicata, Calabria, Campania, Puglia, Sardinia, Sicily as:

- contributions to the costs of research grants for research projects and activity, innovation and technological transfer involving companies;

- programmes to foster the mobility or temporary leave of the staff of universities and research bodies so that they can engage in research activity or technological transfer to companies

4.3.5 The regional funds

Regional governments have a role in influencing research not only by administrating the complementary EU structural funds but, also by funding, with their own funds, programs that involve the research infrastructures present in their respective jurisdictions.

4.3.6 Private funds

The Italian industrial system is made up, for the most part, of small and medium-sized businesses (SMEs) and these are responsible for about 70% of the production of goods and services. On the one hand, this is a factor that works for flexibility, but on the other, it does not allow for a sufficient 'critical mass' for large-scale research projects.

Research, in fact, is carried out, primarily, in a small number of large-scale industrial groups (such as ENI, FIAT, Pirelli, Telecom, ENEL, etc…) which have notable financial resources.

Unfortunately, in the astronomy domain, no sensitive funding cases from the private sector can be reported.

Companies & Astronomy

Astronomy and industrial sectors collaborate on technological projects by building telescopes, electronics, cameras and satellite instruments.
Current INAF policy is trying to improve the collaboration between industry and the astronomical technological spin-offs by the creation of a task force.

4.4 The Personnel

The professional profiles of people enrolled in astronomy research are common to other disciplines due to the similar nature of public bodies or universities.

Research staff positions in universities and research institutes are divided into three different levels: Full Professor/Research Manager, Associate Professor/First Researcher and Researcher.

Long-term (5 years) temporary positions may also be opened for the same three levels, and care has been given to special rules to attract Italian researchers from foreign institutions.

Postdoc positions may be opened by universities and research institutes with or without any direct link with specific projects, while other grants at the post or pre-doctoral level are typically associated with a specific project.

Ph.D. is awarded by universities, which select students with a competitive evaluation procedure. Universities fund also associated grants, without any pre-defined allocation to research projects. Public bodies can also fund supplementary grants for Ph.D. students, either, supplementing the number of grants without any pre-defined allocation to research projects or calling for an explicit link with specific projects.

The employment procedures are generally through public contests for permanent, non-permanent positions and fellowships, both, for scientific and technical-administrative staffs. The announcement for the contest must be published in the *Gazzetta Ufficiale della Repubblica Italiana* (Official State Bulletin) and, also, through nation-wide calls. The procedures to enter the contest are set forth by the law, and require a combination of written and oral examinations, in addition to the CV. The selection is made by an appropriate commission named by the authority (director) of the employing structure.

The stakeholders of targeted projects or directors of divisions can open temporary positions that support the activities of the permanent scientific or technical staff or that pursue a precise target or that fills a job vacancy, by using a form of contract called *Contratto a Progetto (Project Targeted Contract)* awarded after a comparative evaluation procedure of the candidates' curricula.

INAF Personnel (2005)			
Role	**Male**	**Female**	**Total**
Dirigente di Ricerca / Dirigente Tecnologo Research Manager/Technical Manager	63	9	72
Primo Ricercatore / Primo Tecnologo First Researcher/ First Technician	133	29	162
Ricercatore /Tecnico Researcher / Technician	246	88	334
Others	3	0	3
Total Permanent Staff	**445**	**126**	**571**
Fellows	209	107	316
Total	**654**	**233**	**887**

University Personnel (2005)			
Role	**Male**	**Female**	**Total**
Professore Ordinario Professor	58	2	60
Professore Associato Associate Professor	58	6	64
Ricercatore Researcher	48	13	61
Totale staff	***164***	***21***	***185***
Non-Permanent	87	45	132
Total	**251**	**66**	**317**

Chapter 5

The Management of Dutch Astrophysics

An overview of the organisation of the research system in the Netherlands

The Dutch research system is mainly based in universities, top research schools and research and technology institutes. The government acts as a funding source through the Ministry of **OCW** - *Ministerie van Onderwijs, Cultuur en Wetenschap* (Ministry of Education, Culture and Science). OCW is, in fact, responsible for 30 institutions of different sizes, but, it abstains from exercising direction over fundings.

The national research policy is, in fact, carried out by semi-governmental agencies, such as NWO and KNAW.

The government evaluates the universities and research institutes every 6 years through visitations and accreditations based on four criteria (quality, productivity, relevance and chance of success). It also mantains a limited role for specific policy themes and for (inter)national coordination.

In addition, the **NCA** (The Netherlands Committee for Astronomy) acts as a top-level coordinator for Dutch astronomy. This discussion forum coordinates research activities and policy-making decisions among the astronomical institutes in the Netherlands, although it has no funding resources.

5.1 The Players in Astronomy and Astrophysics

The policy making organisations **5.1.1**

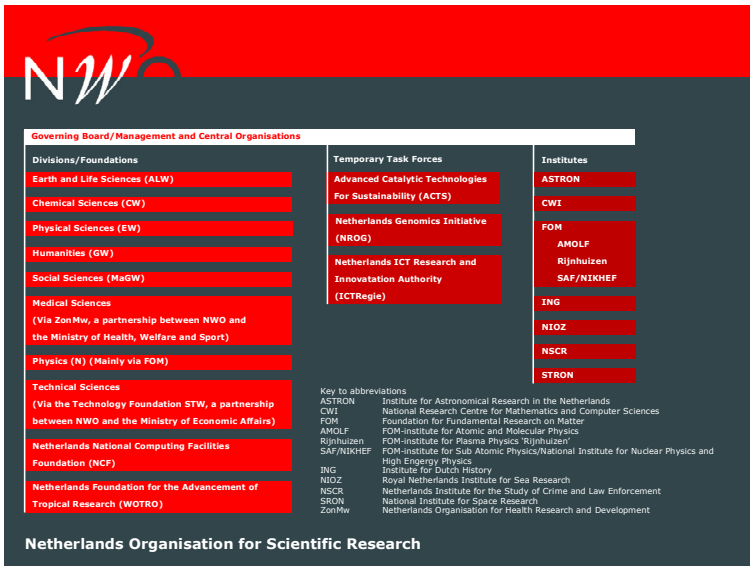
Nederlandse Organisatie voor Wetenschappelijk Onderzoek

The Netherlands Organisation for Scientific Research (NWO) is a semi-governmental organisation that functions as a national research council. It was set up by an act of parliament as an independent organisation, and relies for its funding, almost entirely, on the Ministry of Education, Culture and Science.

Science policy within NWO is determined through its discipline-oriented research councils. Astronomy resides under the Council of Physical Sciences (GBE, mathematics, computer sciences, and astronomy). The GBE also acts as a granting organisation for NWO supported astronomical research in the Netherlands. The mission of the GBE is:

- to stimulate innovative research of outstanding quality;
- to strengthen the knowledge infrastructure;
- optimal international positioning with respect to knowledge and innovation;
- to foster knowledge transfer to society and industry; and,
- enhancing an attractive career perspective for Ph.D. students and postdocs.

To carry out its mission, the Council operates in a multidisciplinary fashion and places the developed knowledge and techniques at the disposal of the community.



Decisions are taken by the GBE Executive Board, which is advised by a policy advisory committee and by the advisory committees for each discipline (mathematics, astronomy and computer science).

Top-level decisions are taken by the Governing Board of NWO. NWO top managers are appointed by the Director and Chair of NWO. On May 22nd 2006, NWO has launched its new strategic plan, 'Science valued! NWO policy 2007-2010'.

5.1.2 *Netherlands Foundation for Research in Astronomy*

The ASTRON institute was founded in 1949 to exploit the new technology of radar and radio communications to allow for exploration of the Universe at radio frequencies. Since that time, its mission has broadened. Its current goal is to enable discovery in astronomy through innovative instrumentation and facilities management. The organisation is an institute of NWO, nearly all ASTRON personnel are employed by NWO. ASTRON hosts the Joint Institute for Very Long Baseline Interferometry in Europe (JIVE), the global project office of the Square Kilometre Array (SKA) and CRAF (the secretariat for the European Science Foundation's standing committee on radio spectrum management).
ASTRON's main lines of observational research are: studies of galaxy structure and evolution; studies of pulsars and other compact objects; studies of the magnetic universe; and, studies in astroparticle physics.

The ASTRON foundation's Board of Governors is responsible for setting global policy at the institute. Its membership reflects the institutional composition of the astronomical community in the country, augmented by several external experts in the areas of importance to ASTRON. NWO's Physical Sciences Council is consulted in appointing board members. ASTRON's board is the management layer between the Governing Board of NWO and ASTRON's Director.

5.1.3 *Netherlands Institute for Space Research*

NWO's institute SRON was founded in 1983 and is the successor of the Geophysics and Space Research Committee (GROC), which was founded in 1961. SRON acts as the national centre of expertise for space research in the Netherlands.

Its mission is to design and develop world-class innovative space instruments for astrophysical and earth-oriented research and to analyse the data provided

by these instruments for advanced research. In addition, SRON promotes, coordinates and supports Dutch activities in space research; advises the Dutch government on the participation in international space research programs, in particular those of ESA.

It is SRON's ambition to act as a PI-institute for the development of the state-of-the-art satellite instruments for space research missions of ESA, NASA or other space agencies.

SRON also houses the Programme Bureau for External Research, which manages the national program for microgravity and earth observation research carried out at universities and other research institutes.

Decisions are prepared by the directors. The executive mandate rests with the general director. Issues regarding strategy require the formal approval of the SRON board to which the directors are accountable to. The SRON board is accountable to NWO.

The SRON foundation runs an institute that consists of laboratories at Utrecht and Groningen. It is headed by a directorate which attends the meetings of the board and the Science Advisory Council. The organisational structure is comprised of several – more autonomous – divisions.

SRON and ASTRON develop their own strategic plans for future research programs.

5.1.4 KNAW Koninklijke Nederlandse Akademie van Wetenschappen

The Royal Netherlands Academy of Arts and Sciences (KNAW) was founded in 1808 by King Louis I Napoleon Bonaparte. The mission of the Academy is to ensure the quality of scientific research in the Netherlands. KNAW offers solicited and unsolicited advice on scientific matters to parliament, ministries, universities and research institutes, funding agencies and international organisations.

In order to perform its advisory task properly, the KNAW has established an advisory council for physics and astronomy. In addition to its own members, scientists working at universities, research institutes and in industry are invited to join this council.

The ESO contact committee was appointed in 1980 by the KNAW. Its objectives are to coordinate and to prepare national policy matters and scientific issues concerning the European Southern Observatory (ESO) in Garching, Germany, and Chile.

5.1.5 NCA - The Netherlands Committee for Astronomy

The Netherlands Committee for Astronomy (NCA) represents the Netherlands in the International Astronomical Union (IAU). It coordinates research activities and policy-making decisions among the astronomical community in the Netherlands. All university astronomical institutes, NOVA, and the NWO institutes ASTRON and SRON are represented at the NCA by their directors. In addition, the astronomical member on the NWO-Physical Sciences Council and the Dutch astronomical members of the ESO Council, and Boards of ING and JCMT are represented. The NCA has no funding resources.

The NCA is currently in the final stage of a mid-term review of the NCA/NOVA/NWO long range plan for astronomy titled 'Astronomy in the Netherlands: 2001 – 2010' and the write-up of a forward look to 2015.

The performing bodies

5.1.6 Nederlandse Onderzoekschool voor Astronomie

The astrophysics research in the Netherlands is carried out in the following five universities' departments:

- University of Amsterdam (UvA) – Astronomical Institute 'Anton Pannekoek'
- University of Groningen (RuG) – Kapteyn Astronomical Institute
- University of Leiden (UL) – Leiden Observatory
- University of Nijmegen (RU) – Department of Astrophysics
- University of Utrecht (UU) – Astronomical Institute Utrecht

Together these comprise NOVA, the Netherlands Research School for Astronomy, a collaboration started in 1991.
In 1998, NOVA was identified by the Dutch government as a national focus area for world-class scientific research (a top research school) and received a grant to carry out a 5 year innovative program on the overall scientific theme: The Life-Cycle of Stars and Galaxies. In 2003, this has been extended until 2008 and recently a third extension has been given until 2013.
The mission of NOVA is to:

- Carry out frontline astronomical research in the Netherlands and
- Train young astronomers at the highest international level.

To achieve the first mission, NOVA not only supports the astronomical research (observational and theoretical), but, also has a coordinating role in instruments development for astronomical observatories (ground-based and in space).

Concerning the second mission, all graduate astronomy education in the Netherlands is concentrated in NOVA. Furthermore, NOVA also monitors and coordinates the MSc education in the Netherlands.

5.2 The Dutch Astronomy @ Main European Organisations

5.2.1 The ESA membership

The funding for the Dutch membership to ESA is covered by the Ministry of Education, Culture and Science and the Ministry of Economic Affairs. The Dutch representation at the ESA decisional boards are shown in the following table:

@ ESA Boards	
ESA BOARD NAME	**APPOINTING INSTITUTION**
Ministerial Level Council	Ministry of Education, Culture & Science (OCW) Ministry of Economic Affairs (EZ)
Council:	Ministry of Education, Culture & Science (OCW) Ministry of Economic Affairs (EZ)
SPC	Ministry of Education, Culture & Science (OCW) Ministry of Economic Affairs (EZ)

In November 2005, three ministries of V&W (Ministry of Transport, Public Works and Water Management), OCW and EZ have initiated the 'Netherlands Space Action Plan'. In addition to astronomy, this plan covers microgravity and earth observations.

5.2.2 The ESO membership

The funding for the Dutch membership at ESO is directly provided by the Ministry of Education, Culture and Science (*OCW*). The Dutch representation at the ESO decisional board is shown in the following table:

@ ESO Council	
POSITION	**APPOINTING INSTITUTION**
Political Member	Ministry of Education, Culture & Science (OCW)
Scientific Member	Ministry of Education, Culture & Science (OCW)

5.3 The Funding

Roughly half of the governmental funding is basic university/institute funding. The other half funds the Dutch granting organisations (e.g., NWO, KNAW), international organisations for fundamental research (CERN, ESA, ESO, EMBL and EMBC), top-research schools (like NOVA for astronomy), (large) technology institutes (e.g., TNO, GTI's) and other departmental research facilities, several research programmes and projects (aimed at e.g., improving the interaction between the demand and supply of knowledge) and instruments to improve research and development in companies.

Finally, some of the research at universities and research institutes are aided by private, charity and industrial funds.

The integrative funding

Roughly, 95% of the Dutch astronomy funding is provided directly or indirectly (e.g. through NWO) by the Dutch government, the remaining funding consists of European and private funding.

The Ministries

Research schools:

On request by the government, KNAW is responsible for the accreditation of research schools. A Research School Accreditation Committee (ECOS) has been created for this, which can decide autonomously on applications from universities for accreditation of research schools.
Assessment rounds have been organised on an annual basis since 1992, when ECOS was founded. Accreditation lapses after six years, when an application for follow-up accreditation may be submitted.

Top research schools:

In 1998, the Dutch Ministry of Education, Culture and Science granted extra funding to six research schools that were identified by the Dutch government as national focus areas for world-class scientific research and satisfied the strict quality criteria. These top research schools were selected by the Governing Board of NWO, based on an advice of an independent committee. NOVA is one of these top research schools.

5.3.1 Nederlandse Organisatie voor Wetenschappelijk Onderzoek

Several competing schemes exist within NWO to ensure funding in astronomy.

The annual Open Competition (including small and medium-sized investments) is to support research proposals without programmatic or thematic restrictions that are of excellent quality.

In addition, NWO Medium & NWO Large investment subsidy are used.
Their purpose is to promote a balanced national investment pattern and to encourage the investment policy of research institutes. Investment subsidies NWO Medium and NWO Large are aimed at investments between 110,000 and 900,000 euro, and larger than 900,000 euro, respectively.

The selection procedure is as follows. Researchers send their research proposals to NWO. For each proposal, NWO uses peer review to judge the proposal in terms of several assessment criteria (e.g. scientific quality, urgency, etc.). The reports from these anonymous referees are available to the researcher, who can provide a rebuttal in which he/she comments on the referees' reports and/or answers any questions that referees may have expressed in their reports.
All the proposals and the corresponding referee reports and rebuttals in the round are thoroughly read by an assessment committee of international experts in the field. The committee discusses each proposal and then makes a prioritisation of the proposals. This results in an advice to the GBE of NWO. The GBE decides which proposals will receive funding.

Veni/Vidi / Vici

The Veni, Vidi, Vici scheme is directed at individual researchers at various stages of their careers. It includes three forms of grant: Veni (for researchers who have recently completed their doctorates), Vidi (for experienced researchers) and Vici (for researchers of professorial quality).
The aim of the scheme is to promote innovation in academic research. It gives creative and talented researchers the opportunity to conduct their own research and so gain entry to or promotion within institutions conducting academic research in the Netherlands.

Candidates will be assessed in a nationwide competition organised and conducted by NWO. On receipt, applications will be screened by the NWO

secretariat to ensure that they comply with the formal requirement of the scheme and that they qualify for consideration for the relevant form of grant (Veni, Vidi or Vici).

If extremely large numbers of Veni or Vidi grant applications are received, councils will be entitled to operate a short-listing procedure based solely on the detailed applications. If a council decides to use the shortlist, applicants will be notified of this in the procedural details accompanying the letter confirming receipt of application. All applications will then be discussed and compared by a broad-based selection committee, which will rate them in terms of their chances of success. Those applicants judged least likely to be awarded a grant will be notified that they have not been short-listed for further consideration. They will have an opportunity to respond to the committee's views. If persuaded by an applicant's response, the committee may decide to short-list the relevant application after all. Otherwise, a formal decision will be taken, against which the applicant may choose to appeal.

The Vici procedure, invariably, involves pre-proposals, these are the so-called applications. The pre-proposals are discussed and compared by disciplinary advisory committees, which then rank them in terms of their chances of success without making use of external referees. The applicants most likely to be successful are invited to prepare detailed applications and submit them by a particular date. The remaining candidates are firmly advised not to pursue their application. Because the advice given to them does not constitute an official decision, there is no formal procedure for lodging an objection or appeal against it.

The detailed applications are submitted to external referees for their considerations. Their views are later sent to the candidate in anonymous form and he/she has the opportunity to respond to them.

If large numbers of applications are received, interviews need not necessarily be held with all candidates. The committee may decide to create a provisional short-list of the most promising candidates, based on the views of the referees and the responses of the candidates. Only they will be invited for interviews.

Following the interviews, the multidisciplinary committee will reach its recommendations. These will be submitted to the relevant council. Only those proposals ultimately rated 'excellent' will be considered for granting.

The council will select the candidates to be awarded grants and will submit a priority list to the Governing Board. Experience has shown that budgetary restrictions are such that awards can be made only to a limited number of the proposals judged worth granting. The final decisions rest with the Governing Board. Once it has decided, the award decisions are made known to the candidates and boards of intended host institutions.

Facilities Core Funding							
Facility	Location	Capital Costs (M€)		Ops Costs (M€)		Part. %	Funding Agencies
National Facilities							
		2004	2005	2004	2005		
DOT	Spain	n/a	n/a	0.35	0.35	100	NWO
WSRT	The Netherlands	n/a	n/a	2.3	2.3	n/a	NWO
International Facilities							
AMANDA	South Pole	-	-	-	-	12.5	-
ANTARES	France	-	-	-	-	25	-
ESA	France	-	-	-	-	4.5	-
ESO	Chile	-	-	-	-	4.5	-
ING	Spain	See info PPARC	See info PPARC	0.57	0.46	26	PPARC, NWO, IAC
JCMT	USA	3,541.6 US$k		3,614.7 3,957		20	

Funding Summary

Source	Title or Type	Theme	Target	Deadlines *					Evaluation	Follow up	Proposals	Approved	Annual Amount
				a	b	c	d	e					
OCW The Dutch Ministry of Education, Culture & Science	Top Research Schools	All scientific themes	Research Schools	Sept 97					Mid 2003 Deadline end June	Continuation for 2005 - 2008	1	1	4.2 M€
OCW & EZ The Dutch Ministry of Economic Affairs	Smart Mix	All themes, from fundamental to applied research through to precompetitive development	Consortia of researchers and knowledge users: scientific institutes, universities of professional education; R&D departments of large and small companies; small and medium sized businesses; cultural and civil-society organisations	Mar '06	Sept & Dec '06[2]	Mar '07	Apr '07	Sept '07	- preproposal - the Smart Mix Secretariat and an independent Smart Mix Advisory Committee (AC) make an initial selection - full proposal - assessment by (inter)national experts - consortium gives a verbal presentation to the AC - AC issues a recommendation - decision by the Minister of Economic Affairs and the General Board of NWO	Yet unknown	155 preproposals (all disciplines) (16 consortia are invited to submit a full proposal)	Decision in April 2007	Yet unknown
NWO Netherlands Organisation for Scientific Research	Open Competition (OC) including NWO-Medium Investment Subsidy (NWO-M)[8] Physical Sciences Council (PSC)	Computer Science, Astronomy and Mathematics	Researchers at Dutch universities, NWO- and KNAW-institutes and the Netherlands Cancer Institute	Jul[3]	Oct	Mar	Apr	Dec	- screening for acceptability (- pre-selection by the Executive Board of the Council) - assessment by referees - candidate's right of reply (rebuttal)[4] - selection committee makes a recommendation to the Executive Board (EB) of the Council - decision by the EB (- right of appeal)	- Annual reports[5] - Final project evaluation at the end of the project	OC 26 (2006) 31 (2005) 21 (2004) NWO-M Astro.: 3 (2006) 3 (2005) 5 (2004)	OC Decision in April 2007 8 (2005) 7 (2004) NWO-M Astro: Decision in April 2007 3 (2005) 5 (2004)	OC M€ 0.5 available (2007) M€ 1.4 (2006) M€ 1.345 (2005) NWO-M Astronomy: Yet unknown M€ 0.97 (2005) M€ 1.1 (2004)

NWO	Innovational Research Incentives Scheme – Veni	All scientific themes	Researchers who have finished their PhD 0-3 years ago	Oct	Yr 1 Jan & Sept Yr 2 May	Yr 1 Jul & Feb Yr 2 Nov	Yr 1 Aug & Mar Yr 2 Dec	Yr 1 Feb & Sept Yr 2 Jun	- screening for acceptability (- short listing by selection committee) - assessment by referees - candidate's right of reply (rebuttal)[4] - interview (selection) - selection committee makes a recommendation to the Governing Board (GB) of NWO - decision by the GB (- right of appeal)	- Annual reports - Final project evaluation at the end of the project	10 (2006, second round) 3 (2006, first round) 4 (2005) 10 (2004)	Decision second round in March 2007 1 (2006, first round) 2 (2005) 5 (2004)	Decision second round in March 2007 k€ 208[6] (2006, first round) M€ 0.4[6] (2005) M€ 1.0[6] (2004)
NWO	Innovational Research Incentives Scheme – Vidi	All scientific themes	Researchers who have finished their PhD 3-8 years ago	Oct	Jan	Jul	Aug	Feb	See evaluation Veni.	- Annual reports - Mid-term project evaluation 2,5 years after the start of the project - Final project evaluation at the end of the project	7 (2006) 6 (2005) 4 (2004)	4 (2006) 2 (2005) 1 (2004)	M€ 2.4[6] (2006) M€ 1.2[6] (2005) M€ 0.6[6] (2004)
NWO	Innovational Research Incentives Scheme - Vici	All scientific themes	Researchers who have finished their PhD 9-15 years ago	Oct	Apr[7] & Sept	Nov	Dec	Jun	- preproposals - screening for acceptability - rating by selection committee - detailed applications - assessment by referees - candidate's right of reply (rebuttal)[4] - interview (selection) - selection committee makes a recommendation to the Governing Board (GB) of NWO - decision by the GB (- right of appeal)	- Annual reports - Mid-term project evaluation 2,5 years after the start of the project - Final project evaluation at the end of the project	pre/full 2/2 (2006) 2/2 (2005) 0/0 (2004)	1 (2006) 1 (2005) 0 (2004)	M€ 1.25[6] (2006) M€ 1.25[6] (2005) M€ 0.0[6] (2004)

NWO	NWO-Large Investment Subsidy[9]	All scientific themes	Universities, NWO institutes, Royal Netherlands Academy institutes, scientific libraries and information centres	Feb '05 [10]	Sept '05	Feb & Apr '06[x]	Jun '06	> Jun '06	- screening for acceptability - assessment by referees - candidate's right of reply (rebuttal)[4] - pre-advise by the Executive Board(s) - rating and pre-selection by selection committee - site visits - selection committee makes a recommendation to the Governing Board (GB) of NWO - decision by the GB and the Minister of Education, Culture & Science (- right of appeal)	Interme-diate progress report	1 (2006) 0 (2005) 1 (2004)	1 (2006) 0 (2004) 1 (2002)	M€ 5 M€ 0 M€ 5.765
NWO	National Programme for Investments in Large-scale Research Facilities (NWO-BIG)[11]	All scientific themes	Universities, NWO institutes, KNAW institutes, academic libraries, academic information providers and research institutions that are mainly funded by public means, TNO, the GTIs and R&D-intensive companies	Sept '05	Oct13th '05	Nov '05	Jul '06	Jan '07	- screening for acceptability (- preselection by the taskforce) (- personal interaction between the taskforce and the applicant) (- taskforce receives external advise) - taskforce makes a recommendation to the Governing Board (GB) of NWO - decision by the Ministers of Education, Culture & Science and Economics Affairs and the GB	Yet unknown	1	0	€ 0

NWO	Casimir	Primarily Science & Technology	Trio's consisting of a talented graduate or researcher at a knowledge institution or company in the Netherlands, a representative of a company, and a representative of a knowledge institution	May	Sept	Oct	Nov	Mar	- screening for compliance with formal requirements - ranking by a cross-disciplinary assessment committee - interview (most promising applications) - assessment committee makes a recommendation to the Governing Board (GB) of NWO - decision by the GB	- Annual report - Site visits - Final project evaluation at the end of the project	Astro.: 2	Astro.: 0	Astronomy: € 0
NWO	Rubicon	All scientific themes	Postgraduates who are currently engaged in doctoral research or who have been awarded a doctorate in the twelve months preceding the relevant deadline	cont.	Apr, Sept & Dec '06 [12]	Jun & Nov '06 & Feb '07	Jul & Dec '06 & Mar '07	Nov '06 & Apr & Jul '07	- screening for compliance with formal requirements - ranking by a cross-disciplinary assessment committee - assessment committee makes a recommendation to the Governing Board (GB) of NWO - decision by the GB	- (Intermediate progress report[13]) - Final project evaluation at the end of the project	Astro.: 2 (2nd round 2006) 3 (1st round 2006) 4 (2005)	Astro.: 1 (2nd round 2006) 0 (1st round 2006) 2 (2005)	Astronomy: k€ 67.02 (2nd round 2006) k€ 0 (1st round 2006) M€ 1.3882 (2005)
KNAW	Hendrik Casimir-Karl Ziegler Research Grant	Natural and Life Sciences and Social Sciences & Humanities alternately	Post-docs	Oct	Dec 31st	Feb	Apr	Sept	Selection committee KNAW Board	-	-	-	-

a call announcement
b deadline
c evaluation
d granting
e start-up

[1] Top Research Schools: There was only one round of the Top Research Schools Programme (i'97/'98).
[2] Smart Mix: September: preproposal, December: full proposal
[3] Open Competition: These deadlines can differ per year, the given deadlines are for the 2006 round.
[4] Open Competition, Veni, Vidi, Vici Scheme: The views of the referees are sent to the candidate in anonymous form and he/she has the opportunity to respond to them.
[5] Open Competition: An annual report essentially consists of a verification of the main project details and a list of the publications and other products that appeared during that year.
[6] Veni, Vidi, Vici Scheme: NWO provides 67,6 % of the subsidy, the remaining 32,4% consists of matching by the university.
[7] Vici Scheme: April: preprosal, September: full proposal
[8] NWO-M: Investment subsidies NWO-Large are aimed at investments between 110,000 and 900,000€.
[9] NWO-Large: Investment subsidies NWO-Large are aimed at investments larger than 900,000 euro.
[10] NWO-Large: Once every two years.
[11] NWO-BIG: Investment subsidies NWO-BIG are aimed at investments in new research facilities larger than M€ 25.
[12] Rubicon: There are three selection rounds per year for Rubicon grants.
[13] Rubicon: Intermediate Progress Reports are only required if the researcher works abroad for more than 1,5 years.

5.4 The Personnel

Permanent positions:

A new position is opened when a researcher leaves (e.g., moves to another institute, retires) or when a new position is created due to the importance of the research topic. These positions will be advertised and everybody can apply. Selection of the candidates is done by a selection committee that is typically composed of scientists from both the institute where the new position is open as well as from external experts.

Temporary positions:

Ph.D. students and postdocs can apply for available Ph.D./postdoctoral fellowships, which are publically advertised by the grant holder. The selection is performed by the grant holder according to selection criteria of his/her choice.

Furthermore, temporary positions are available for young researchers via the Veni, Vidi, Vici scheme grants.

All graduate education in the Netherlands is concentrated in NOVA. NOVA ensures broadening in the graduate education and is furthermore concerned with monitoring of all astronomical Ph.D. studies in the Netherlands, with emphasis on presentation skills and career prospects.

Astronomers in Universities Departments

Role	Level	Male	Female	Average Salary	Average Cost for the Employer	Average Age
Permanent Researchers	Full Professor	32.2	1.4	81,250 / yr	125,000 / year	54.2
	Associate/Assistant Professor	52	4	57,200 / yr	88,000 / year	46.3
Technician		5	0	45,500 / yr	70,000 / year	-
Post-Docs & Tenure Tracks		42	14	50,700 / yr	78,000 / year	33.1
Ph.D. Students		98	26	29,250 / yr	45,000 / year	27.2

Astronomers in Research Bodies

Role	Level	Male	Female	Average Salary Range	Average Cost for the Employer	Average Age
Permanent Researchers	Senior Scientist (SRON)	6	0	4,800 / mnth	7,050 / mnth	50
	Junior Scientist (SRON)	4	0	3,250 / mnth	4,775 / mnth	45
	Scientist (ASTRON)	48	3	3,342 / mnth	4,631 / mnth	42
Technician	Senior (SRON)	4	0	4,800 / mnth	7,050 / mnth	50
	Junior (SRON)	6	0	3,250 / mnth	4,775 / mnth	43
Post-Docs & Tenure Tracks		15	3	3,165 / mnth	4,591 / mnth	32
Ph.D. Students		6	1	2,250 / mnth	3,307 / mnth	27

Chapter 6

The Management of Spanish Astrophysics

An overview of the organisation of the research system in Spain

The Spanish research activities are mainly public and most of the funds for research and infrastructures are provided by the state and by the regional governments (*Comunidades Autónomas*). Science and technology policies are organized through the public sector according to the scheme that was established in the Science Law of 1986 (*Ley de Fomento y Coordinación General de la Investigación Científica y Técnica*, otherwise, known as *Ley de la Ciencia 13/1986, April 14th*).

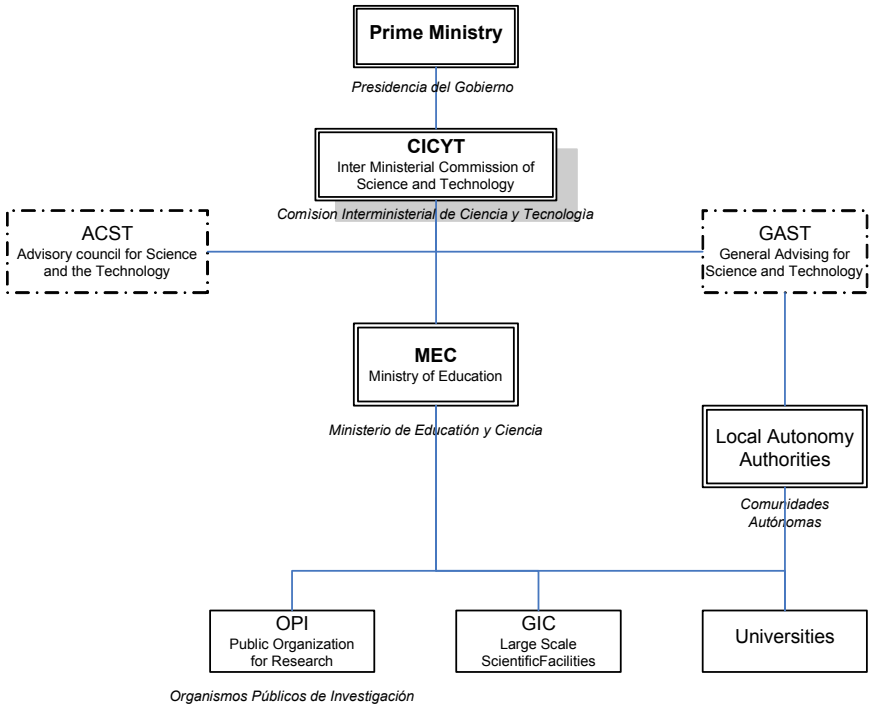
Both national and regional administrations produce a research programme every few (typically four) years: the national government plan provides for the national strategic priorities, the regional plans outline the main research priority areas to support and enhance the research and development in their own territories. Such plans do not include permanent positions policy.

The National Plan for Scientific Research, Development and Technical Innovation (*Plan Nacional de Investigación Científica, Desarrollo e Innovación Tecnológica*, **Plan Nacional de I+D+I**) is the government mechanism to coordinate the different agents. It was created in 1988 and is issued by the **CICYT** - *Comisión Interministerial de Ciencia y Tecnología* (Inter-ministerial Commission of Science and Technology), and has three main goals: give incentives to, coordinate and plan all research and development activities. It also identifies the guidelines of research policy by specific programmes in the main areas of science.
The CICYT receives recommendations of the *Comisión Nacional de Astronomía* (**CNA**), an advisory committee created in 1989 and composed mainly of the directors of the Spanish astronomy institutes, the president of the Spanish Astronomical Society (*Sociedad Española de Astronomía*, **SEA**) and highly qualified experts in the following fields of astronomy research: cosmology, galaxies, stellar physics and interstellar medium, Sun and Solar System,

positional astronomy, instrumentation and space. At least, two of the experts have to be university staff. The CNA is also in charge of the official relationship with the International Astronomical Union.

Finally, the Plan is executed by the Ministry of Education and Science (*Ministerio de Educación y Ciencia*, **MEC**). In Figure 1, the role of different institutions are sketched.

The National Plan is revised and updated on a regular basis. The first major revision took place in 1991, when indexes of international institutions as OCDE or EUROSTAT were used.
It is worth noting that other ministries, such as the Ministry of Industry, Tourism and Trade, the Ministry of Defence, and the Ministry of Employment and Social Services, execute research policies in their respective fields of activities.



General scheme of the main national Spanish institutions in research and development activities.

6.1 The Players in Spanish Astronomy and Astrophysics

Research in Spanish astronomy is executed by universities, public bodies, private centres and joint ventures or consortia among them.

A few public bodies (mainly, *Instituto de Astrofísica de Canarias*, *Instituto de Astrofísica de Andalucía* and *Observatorio Astronómico Nacional*) host almost half of the astrophysicists in Spain. The rest are spread mainly in small institutes or university groups, where *Universidad de Barcelona* and *Universidad de Valencia* have the most numerous teams.
However, one of the problems of Spanish astronomy is the large number of small groups. For this reason, both national and regional administrations are supporting the creation of research consortia and efforts to join networks.

In Figure 2, a general overview including the players in Spanish astronomy is shown. Please note that the "Universities" section has not been developed in detail and the long list of university departments and research groups are not specified. See below for more details about universities.

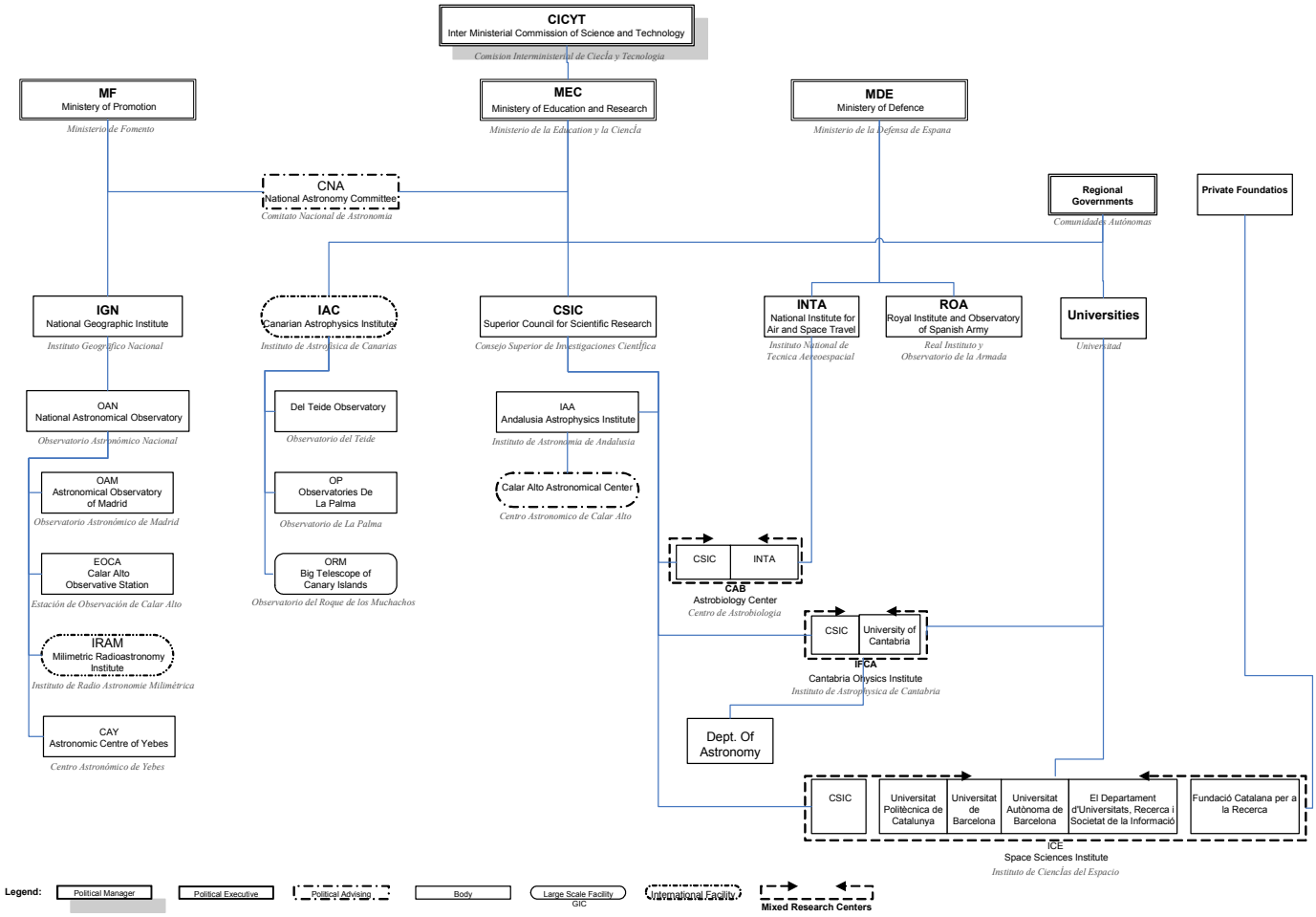
Based on a study published by the *Sociedad Española de Astronomía* (**SEA**) in 2002 and covering the period 1999-2002, the main areas of activities in astrophysics in Spain are:

- Galactic and stellar astronomy 42%
- Extragalactic astronomy 24%
- Scientific planet exploration 10%
- Solar physics 6%
- Others 18%

Related astronomy subjects are:

- Astrobiology, basically performed by biologists and geologists
- Earth Science
- Space Weather

Astroparticle physics is another field with growing impact in Spain. In terms of infrastructure (for example, in the construction and operations of the MAGIC Cerenkov telescope), groups traditionally engaged in high-energy physics have taken the lead. Now, the exploitation of these facilities is clearly beneficial for a much wider community, including some very active groups in high-energy astrophysics.



General overview including the players of Spanish Astronomy. Please note that the "Universities" section has not been developed in detail and the long list of university departments and research groups are not considered.

The number of Spanish astrophysicists is relatively small, with 460 researchers in 2002, that corresponds to 11.8 per million of inhabitants.

The training of new researchers is quite active, with an average of 25 Ph.D. theses per year in 2004-2006. More recent data suggests that the Spanish R&D system now contains over 500 professional astronomers, including Ph.D. students. Out of these, well over 350 have their Ph.D.s completed and conduct independent research. About one half of these people have permanent positions in universities and research centres. They are assisted by about 150 technical people totally devoted to astronomy.

SPANISH ASTRONOMERS

Permanent positions	229
Postdoctoral positions	94
Ph.D. students	137

The Spanish astronomy has a strong observational component, with an estimated fraction of 52% of the publications are based on data collected with instruments. Theoretical works, including numerical simulations, reaches about

44%. Barcons et al. (2002) found that on average, the number of computers was 2.7 per researcher. Only the three largest bodies had more than 50 computers. Computing is a pressing need of modern astronomy and astrophysics, for which the Barcelona Supercomputing Centre (hosting the Mare Nostrum super-computer) is an important asset that devotes a relevant part of its scientific service to astronomy projects. It and other smaller infrastructures have lent support to a steeply rising activity in numerical astrophysics.

With respect to the wavelength range, Spanish astronomy has a strong optical component (52% of researchers), whereas, new ranges as infrared (17%) and radio (19%) are growing following the general international trend motivated by the emergence of new space observatories. High-energy astrophysics has a long tradition and is a healthy but relatively small area (~12%).

Several Spanish institutions belong to the European Research and Training Networks, sharing EU resources with other European institutions.

Four networks are currently supported by the MEC Nacional Plan: Exoplanets, Computational Astrophysics, Virtual Observatory and Extragalactic Surveys. These networks receive funds mainly for the organisation of meetings, schools and workshops to increase collaboration among researchers.

Finally, the Ministry of Education and Science has recently granted more than five million euros, under the new Consolider-Ingenio 2010 program, for a large five-year project on the early scientific exploitation of the Spanish 10m telescope GTC. This project joins efforts of almost one hundred Spanish astrophysicists belonging to more than ten institutions.

6.1.1 Consejo Superior de Investigaciones Científicas

The largest Spanish research public body is the Superior Council for Scientific Research that plays an active role in the science policy through many centres across Spain.

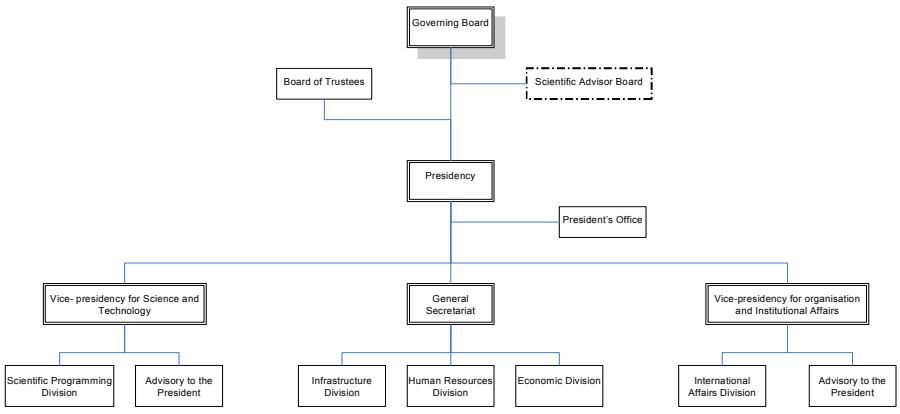
On 11 January 1907 the Council for the Extension of Studies and Scientific Research *("Junta para Ampliación de Estudios e Investigaciones Científicas"*, **JAE**) was created by a ministerial decree signed by the Minister for Public Instruction and Fine Arts.

The aim of this new body, which inherited the principles of an independent teaching institution, was to end Spain's isolation and forge links with European science and culture. It also had the mission of training the staff responsible for implementing the reforms needed in the sphere of science, culture and education.

In 1939, out of the JAE's laboratories, premises and centres, Franco's newly installed regime created the Spanish National Research Council *("Consejo Superior de Investigaciones Científicas"*, **CSIC**) under the presidency of the Minister for Education, José Ibáñez Martín, with the close collaboration of José María Albareda, who was appointed secretary general of the CSIC. The Law passed on 24 November 1939 creating the CSIC which declared that "all the centres belonging to the dissolved Council for the Extension of Studies and Scientific Research (JAE), the Foundation for Scientific Research and Reform Trials and those created by the Spanish Institute would become part of the Spanish National Research Council.

Today, CSIC has become the largest research public body. Current management is described in Figure 3.

As a multidisciplinary body, CSIC covers all fields of knowledge from basic research to advanced technological developments and it is organised into eight scientific and technical areas distributed in 116 institutes and centres (40 mixed centres and 10 services centres).



Management structure of the CSIC.

The following four institutes are involved in astrophysics research and belong to the Physical and Technological Sciences Area (*Área de Ciencias y Tecnologia Físicas*): *Instituto de Astrofísica de Andalucía* (**IAA**), *Instituto de Física de Cantabria* (**IFCA**), *Instituto de Ciencias del Espacio* (**ICE**) and *Centro de Astrobiología* (**CAB**). In addition, the *Departamento de Astrofísica Molecular e Infrarroja*, a section of the *Instituto de Estructura de la Materia*, hosts several active research groups.

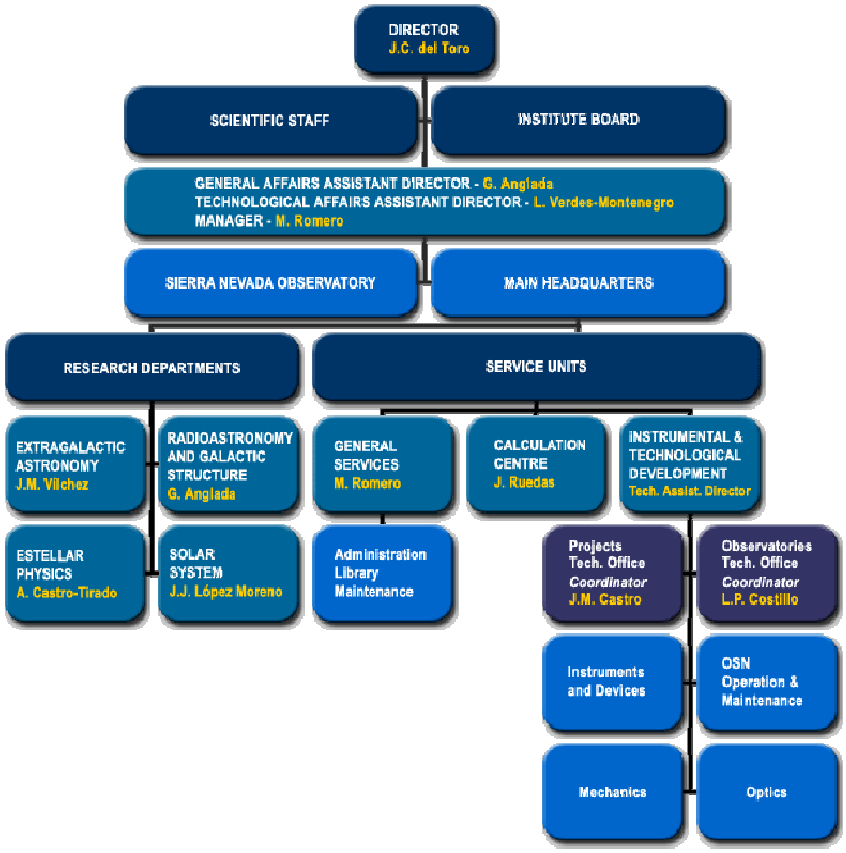
Instituto de Astrofísica de Andalucía (IAA)

The IAA was created in Granada, as its own centre within the CSIC, in July 1975. IAA manages two astronomical observatories: the Observatory of Calar Alto and the Sierra Nevada Observatory (*Observatorio de Sierra Nevada,* ***OSN***).

The OSN is operated by the IAA and holds 1.5m and 0.9m optical telescopes installed in 1991. The German-Spanish Astronomical Center at Calar Alto is located in the Sierra de Los Filabres, north of Almería (Southern Spain). It is operated jointly by the Max-Planck-Institut für Astronomie (MPIA) in Heidelberg, Germany and the IAA. Calar Alto provides three telescopes with apertures of 1.23m, 2.2m and 3.5m to the general community.

The IAA is a full-time astrophysics institute whose activities are performed by the following departments:

- Extragalactic Astronomy (43 researchers)
- Stellar Physics (19 researchers)
- Radioastronomy and Galactic Structure (21 researchers)
- Solar System (28 reserachers)



Scheme of the IAA management structure.

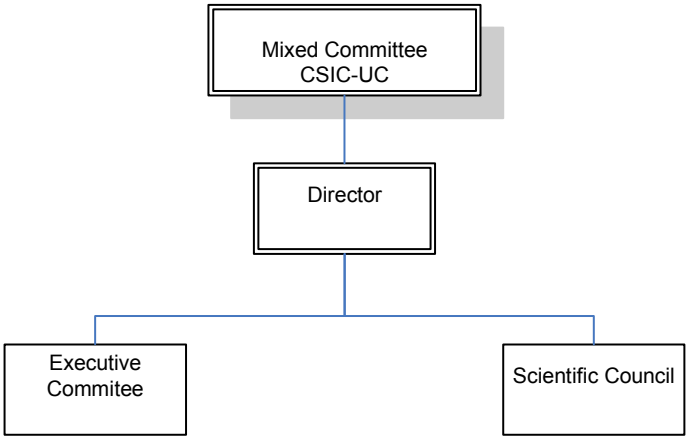
Instituto de Física de Cantabria (IFCA)

The Institute of Physics of Cantabria is a research centre shared by the CSIC and the University of Cantabria (UC). It was formally established on June 8th 1995.

At the present time, the IFCA has a scientific group of 24 astrophysicists and 20 staff members, including technicians and administrative personnel.

The research teams of the Institute are engaged in several projects funded by the National Plan of Astronomy and Astrophysics and also by the National Plans of Space Exploration, Information Technology, Communications and Sectorial Plan of General Promotion of Knowledge.
The Institute is structured into two research departments that define the guidelines for activities in: astrophysics and structure of matter.

The considered annual cost of IFCA is more than 1.5 million euros, more than half being for personnel expenses, around 40% real investments and 10% current expenses. Nearly 40% of the budget is obtained by means of external financing, mainly through calls for projects of the National Plan.



Detailed scheme of the IFCA management structure.

Main topics of research at IFCA are:

- X-ray astronomy
- Radiogalaxies
- Microwave Background Radiation and large scale structure
- Astronomical instrumentation for large telescopes

Instituto de Ciencias del Espacio / Institut d'Estudis Espacials de Catalunya

As an institute of the CSIC and a unit of the *Institut d'Estudis Espacials de Catalunya* (**IEEC**), the Institute of Space Sciences (**ICE**), in Barcelona, aims to contribute significantly to the scientific and technological research, doing science of and from space. Hence, the Institute is putting special emphasis on instrumentation on-board satellites as well as all the technical aspects involved in such projects. The ICE was created by CSIC in 1999 and hosts about 50 researchers.

The ICE is active in the following disciplines:

1) Cosmology and gravitation, high-energy astrophysics
2) Galaxies
3) Stellar physics
4) Molecular astrophysics and interstellar medium
5) Spatial and terrestrial instrumentation

Centro de Astrobiología (CAB)

The **CAB**, Astrobiology Centre (Madrid) is a mixed research centre shared by the CSIC and the **INTA**, the Institute for Aerospatial Studies. Its aim is to perform research in astrobiology, a new science that arose from the necessity to investigate the origin, evolution and consequences of life in the Universe.

The Centre for Astrobiology is associated with the NASA Astrobiology Institute (NAI), and hosts more than 20 senior and 30 junior researchers supported by about 20 technicians. Activities are structured in the following laboratories:
1) Transdiscipline Laboratory: where the experts of the diverse areas interact to exchange knowledge and to design/execute experiments or to construct multidisciplinary instruments,
2) Computation Laboratory, and
3) Laboratory of Planetary Geology.

Departamento de Astrofísica Molecular e Infrarroja (DAMIR)

The Department of Molecular & Infrared Astrophysics (**DAMIR**) of the *Instituto de Estructura de la Materia* (Madrid) was established as a result of the merger of two CSIC research groups: Astrophysics and Theoretical Chemistry. DAMIR hosts more than 15 researchers (six of them senior). Activities are structured in three interdependent research areas:

1) Observational Astrophysics: Molecular spectroscopy of the ISM and multi-range infrared astronomy of stars and galaxies.
2) Theoretical Astrophysics: Development of radiative transfer codes for molecules in the ISM and the Earth's atmosphere.
3) Theoretical Chemistry: Ab initio calculations of outstanding molecular species in astrophysics and cross-section calculations of ion-atom, ion-molecule collisions.

DAMIR is strongly implied in the millimetre-submillimetre interferometer ALMA project, the new infrared satellite HERSCHEL and the James Web Next Generation Space Telescope.

DAMIR is the institution coordinator of ASTROCAM, a multi-institution research and development program of the Comunidad de Madrid (Madrid Autonomous Government).

6.1.2

Observatorio Astronómico Nacional (OAN)

The **OAN** – National Astronomical Observatory – is part of the **IGN** – National Geographic Institute (*Instituto Geográfico Nacional*) – that belongs to the Ministry of Public Works (*Ministerio de Fomento*). Several astronomical facilities are managed by OAN:

- Yebes Astronomical Centre (**CAY**): Large astronomical facility that hosts a 40m radiotelescope, a 14m radiotelescope and a few small telescopes.
- Observational Station of Calar Alto (**EOCA**): Within the Calar Alto Observatory, it harbors a classical 1.52m telescope with several postfocus instruments.
- Astronomical Observatory of Madrid (**OAM**): Created in 1790, it is constituted by several historical buildings and headquarters.
- Alcalá de Henares Centre: Main OAN headquarters since 1995.
- OAN leads the Spanish partnership in IRAM (Institute of Millimetric Radio Astronomy), an international collaboration with the German MPG and the French CNRS in the millimetric radio-astronomy studies. IRAM, founded in 1991, operates the 30 meter radiotelescope placed in Pico Veleta (Granada) and the interferometer of six antennas in the Plateau de Bure (France).

OAN hosts more than 50 researchers supported by a large number of technicians. The activities in the field of instrument development are very important and include: microwave amplifiers, holography, microwave receptors, spectral detectors and Very Large Baseline Interferometry.

Research activities are structured in the following areas:

1) Stellar formation
2) Astrochemistry
3) Interstellar medium
4) Evolved stars
5) Extragalactic astronomy
6) VLBI, Very Large Baseline Interferometry

In addition, OAN hosts the Spanish ALMA office.

OAN Researchers have always been very active with respect to high-level teaching. In this respect, courses for post-graduate students are offered in a regular basis for post-graduate studies at *Universidad Complutense de Madrid* (**UCM**), *Universidad Autónoma de Madrid* (**UAM**), *Universidad de La Laguna* and *Universidad de Alcalá*.

6.1.3 Instituto de Astrofísica de Canarias (IAC)

Formally founded in 1975, the *Instituto de Astrofísica de Canarias* (**IAC**) is the largest astronomy centre. It comprises:

- the *Instituto de Astrofísica*, which forms the main headquarters, in La Laguna (Tenerife).
- the *Observatorio del Roque de los Muchachos* (**ORM**; La Palma).
- the *Observatorio del Teide*, in Izaña (**OT**; Tenerife).
- Common Centre for Astrophysics on La Palma (**CALP**).

Jointly, these form the so-called European Northern Observatory. The Spanish membership at consortium involves the MEC, the CSIC, the University of Laguna and the regional government of the Canary Islands.

About 25-30% of all researchers in astronomy in Spain work at the IAC, but this amount is much higher when counting technical staff. In 2006, the IAC was composed of more than 50 senior, 50 postdoctoral and a similar number for junior researchers, complemented by about a large number of technicians. Activities are structured in the following lines of research:

1) Structure of the Universe and cosmology
2) Structure and evolution of galaxies
3) Interstellar matter
4) Structure and evolution of stars
5) The Sun
6) Solar System
7) History of astronomy
8) High Spatial Resolution Techniques and atmospheric optics
9) Optical instrumentation
10) Infrared instrumentation
11) Astrophysics from space

The IAC has a well established and recognized tradition in the training of researchers. The Graduate Studies Division of the IAC organizes and coordinates the Institute's activities in collaboration with specialized university education in astrophysics (Master in Astrophysics) and the training of scientific and technical staff in all fields related to astrophysics. The IAC winter school is an international Postgraduate School that has about 60 students from many different countries each year.
Each year the IAC organizes a Summer Studentships Programme as an introduction to research. The grants, of three months' duration, are aimed at undergraduates and engineering students in their final year of degree studies.
Also, every year the IAC offers a Doctoral Studentships in astrophysics program. The aim of this programme is to prepare recent graduates for research in astrophysics and its related techniques. During the period of training, students carry out their doctoral studies at the University of La

Laguna under the supervision of a tutor and undertake research work leading to a doctoral thesis as part of a research group at the Institute.
At the post-doctoral level, the IAC has established official agreements with other institutions and offers grants for postdoctoral positions at the IAC and other institutions.
In the field of technological development, the IAC is also an advanced technology centre, where scientific-technical and other applications of general use are developed in the IAC's Instrumentation Division. Human resources sum up to about 80 technicians highly specialized in the areas of project management, software, electronics, optics, mechanics, technical design and instrument maintenance.

The IAC's headquarters and the administrative base of the international observatories are located in the campus of the University of La Laguna. As the place of work for the majority of its staff, it is a meeting point for the international astronomical community, a centre for research, technological development and training of researchers, engineers and technicians. It is also an active promoter in science education. For these activities, it draws on the following facilities:

- *Oficina de Transferencia de Resultados de Investigación* (**OTRI**)
- *Oficina Técnica para la Protección de la Calidad del Cielo* (**OTPC**)
- Common Informatics Services
- Laboratories
- Workshops and Services
- Residence

The *Observatorio del Roque de los Muchachos* (**ORM**), inaugurated in 1985, holds telescopes and other instrumentation belonging to over 60 institutions from 19 countries. The institutions from various countries participate in the Observatory through the International Science Committee (*Comité Científico Internacional***, CCI**).
The ORM constitutes one of the largest astronomical observatories of the world. Roque de los Muchachos provides solar telescopes with apertures of 1m and 0.4m and optical telescopes with apertures of 4.2m, 3.5m, 2.56m, 2.5m, 2m, 1.2m, 1m and other facilities to the general community.

The *Observatorio del Teide* (**OT**) holds telescopes and other instrumentation belonging to over several institutions from different countries. OT provides solar telescopes with apertures of 1.5m, 0.9m and 0.7m and optical telescopes with apertures of 1.55m, 1.2m, 1m, 0.8m and other facilities to the general community.

The Common Centre for Astrophysics on La Palma is a common sea-level site with a support infrastructure for servicing telescopic installations.

6.1.4

The GTC 10m telescope

The *Gran Telescopio CANARIAS* (**GTC**), is a high performance segmented 10.4m optical and infrared telescope that is being installed in the Roque de los Muchachos Observatory (La Palma, Canary Islands, Spain). First light is planed for spring 2007.

The GTC project is a Spanish initiative, led by the IAC (*Instituto de Astrofísica de Canarias*), with the firm support of the Spanish Central Administration and the Regional Government of the Canary Islands (51% and 49% of Spanish contribution, respectively), the participation of Mexico through **IA-UNAM** (*Instituto de Astronomía de la Universidad Nacional Autónoma de Mexico*) and the **INAOE** (*Instituto Nacional de Astrofísica, Óptica y Electrónica*) and USA through the University of Florida. Spanish contribution sums up to 90%, whereas Mexico is 5% and University of Florida 5%.

The GTC Project Office is an independent body with the status of a Spanish non-profit enterprise called Grantecan S.A. Its creation was promoted by the IAC to provide the GTC project with efficient management and executive capabilities. Grantecan was created in mid-94 by the Canarian regional government. Now, its ownership is shared between the Canarian regional government and the Spanish national government.

Ministry of Education and Science has recently granted more than five million euros, under the new Consolider-Ingenio 2010 program, for a large five years project for the early scientific exploitation of the Spanish 10m telescope GTC. This project joins the efforts of almost one hundred Spanish astrophysicists belonging to more than ten institutions.

6.1.5

Instituto Nacional de Técnica Aeroespacial

The **INTA** (National Institute for Aerospace Technology), created in 1942, is the Spanish public institution devoted to aeronautics and aerospace research and development under the patronage of the Ministry of Defence.

The main headquarters is located in Torrejón (Madrid), but INTA is a large and complex institution with a budget of about 100 million euros, 60% dedicated to scientific and technological equipments.

INTA teams carry out more than 100 research projects: 65% in technological developments, 27% in applied research and 8% in basic research. The basic technological areas developed by INTA are related to aeronautical technology (40%), space technology (46%), and the remainder is shared among the various technologies of energy, environment, road vehicles and road safety. All of these take up 14% of the budget.

INTA's staff is comprised of over 1,200 individuals, of whom, approximately a thousand are dedicated to research and development activities. More than 40% of the Institute's personnel have a university degree. In addition, the Institute carries out an intense training program for both scientists and technicians, not only of its own staff but, also, for scholarship holders, who surpass the hundred mark, and are mainly university graduates, approximately half having Ph.D. degrees.

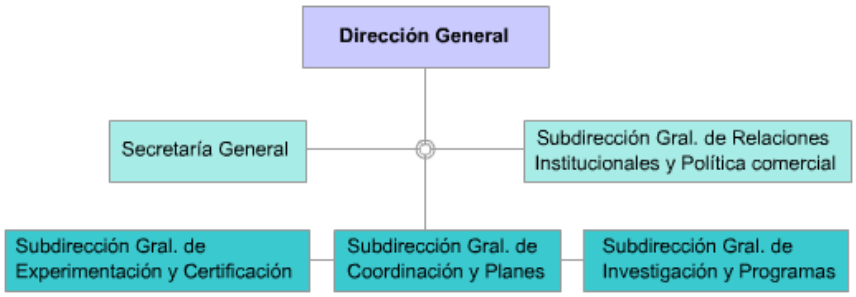
INTA provides technical assessment and services to public bodies and industrial and technological firms. The income, derived from these activities, finances a fifth of the Institute's budget. A third of this income comes from contracts with foreign institutions, mainly European ones, (principally, the European Space Agency). The rest of the income are proceeds from the work carried out for Spanish industry, approximately another third, and from other state administration bodies, principally, the Ministry of Defence.

In order to develop its activities, INTA is structured into departments and centres that, according to their own particular areas of competence, can be grouped into two important areas:

- Research + Development + Innovation (R+D+i)
- Certification and Testing

The R+D+i area is also involved in the space program, structured in the following departments:

- Aerodynamics and Propulsion,
- Space Sciences and Electronic Technologies,
- Materials and Structures,
- Earth Observation,
- Remote sensing and atmosphere,
- Aeronautical Programmes,
- Space Programmes.



Detailed scheme of the INTA management structure

INTA is the sole proprietor of the company INSA, which provides specialised technical services in the state-of-the-art technology fields and develops activities related to aeronautical and space engineering. Apart from this, as an

instrument of the Ministry of Defence, it also participates in private companies operating in the space industry. Hence, it forms part of the HISPASAT company with 16% of the shares.
Most of INTA's astrophysics research activities are those performed in CAB, a mixed research centre shared with CSIC (see CAB in the above CSIC section), and LAEFF, a mixed research centre shared with CSIC and created in collaboration with ESA.

6.1.6

Laboratorio de Astrofísica Espacial y Física Fundamental (LAEFF)

LAEFF (Laboratory for Space Astrophysics and Theoretical Physics) was founded in 1991 as a collaboration between INTA, CSIC and the European Space Agency (ESA). It is located at Villafranca Satellite Tracking Station (VILSPA), now renamed as European Science Astronomy Centre (**ESAC**), near to Madrid, to allow for closer interaction with the ESA astronomical activities (IUE, ISO, XMM,...).

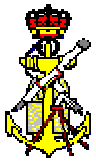
LAEFF hosts about 25 senior and junior astrophysicists. Research is carried out in different areas of astrophysics:

- Astroparticle physics
- Interstellar medium
- Brown dwarfs and stellar physics
- Solar physics
- Extragalactic physics
- Virtual Observatory

LAEFF is also responsible for the radio astronomical use of the antennas in the Robledo de Chavela station.

LAEFF participates in the development of different space projects, such as OMC-INTEGRAL, EURD, LEGRI and EDDINGTON. It is also involved in the development and maintenance of Astronomical Data Archives of space missions (INES, OMC) and ground-based telescopes (GAUDI) in the framework of the Spanish Virtual Observatory project.

6.1.7



Real Observatorio de la Armada (ROA)

The Royal Observatory of the Navy (**ROA**) belongs to the Ministry of Defence. Created in 1753 at San Fernando (Cádiz), it trains the Navy's officers in navigation techniques, ROA runs and has among other projects, the Carlsberg Meridian Telescope. Its activities are currently

more related to celestial mechanics and ephemeris in close collaboration with the International Astronomical Union. ROA is supported by the Ministry of Defence and offers highly qualified technical support to the Spanish Navy.

6.1.8 Universities

The universities have a long tradition and represent a significant contribution in Spain research. University departments, where research is conducted along with teaching, host several astronomy groups that are highly fragmented. However, as a whole, they produce half of all publications of Spanish astronomy. In the following table, the list of the main research groups in astronomy and astrophysics hosted by Spanish universities are shown. Only two university groups have more than 25 researchers, four groups have between 20 and 25 researchers, twelve groups have more than 5 and less than 10 researchers. Finally, six groups have less than 5 researchers.

Astrophysics is a subject well-liked by most of the physics students, and most of physics programmes have incorporated at least one or two subjects on astronomy. Few universities (Barcelona, La Laguna, Madrid, Valencia, Santiago de Compostela, Zaragoza, Islas Baleares and Granada) have astronomy professorships, but teaching at university level in Spain is being radically modified by the Bologna Declaration. Until 2006, the physics studies at *Universidad Complutense de Madrid* and *Universidad de La Laguna* included astrophysics as an orientation or research profile.
Starting in 2006, Masters have been introduced, some of them in astrophysics.

UNIVERSITY DEPARTMENT OF PHYSICS PERFORMS ASTROPHYSICS	
Dpto. d'Astronomia i Meteorologia	U. Barcelona
Dpto. de Astrofísica	U. La Laguna
Dpto. d'Astronomia i Astrofísica	U. de València
Dpto. de Astrofísica y CC Atmósfera	U. Complutense de Madrid
Dpto. de Física Moderna	U. de Cantabria
Dpto. de Física Teórica	U. Autónoma de Madrid
Dpto. de Física Teórica y del Cosmos	U. de Granada
Dpto. de Física Aplicada I	U. del País Vasco
Dpto. de Física, Ingeniería de Sistemas	U. de Alicante
Dpto. de Ciencias Náuticas y de la Tierra	U. da Coruña
Dpto. de Física	U. de Extremadura
Dpto. de Física Atómica y Nuclear	U. Complutense de Madrid
Instituto de Astronomía y Geodesia (IAG)	U. Complutense de Madrid/CSIC
Dpto Física Aplicada	U. de Vigo
Grupo de Rayos Cósmicos	U. Alcalá de Henares
Obs. Astronómico "Ramón María Aller"	U. de Santiago
Grup d'Astronomia i Astrofísica	U. Politécnica de Catalunya
Area de Física Teórica	U. de Salamanca
Dpto. de Física Aplicada	U. de Jaén
Dpto. de Física Teórica	U. del País Vasco
Dpto. de Física	U. de les Illes Balears
Dpto. de Física	U. Europea de Madrid
Dpto de Física	U. de Oviedo
Dpto de Matemática Aplicada	U. de Oviedo
Dpto Inteligencia Artificial	U. Nac. Educ a Distancia
Dpto. de Física Aplicada	E. Politécnica Sup de Alcoi
Dpto. de Matemàtica Aplicada IV	U. Politècnica de Catalunya
Dpto. de Física Teórica	U. de Zaragoza
Grupo de Mecánica Espacial	U. de Zaragoza
Observatorio del Ebro	U. Ramon Llull
Observatorio Fabra	U. Barcelona
Dpto. de Matemática Aplicada y Estadística	U. Politécnica de Cartagena
Dpto. D'Eng. Informàtica	U. Rovira i Virgili
Dpto Física Atómica, Molecular y Nuclear	U. de Sevilla
Escuela Téc. Sup. Ingenieros Industriales	U. de Valladolid

AVAILABLE MASTER LIST	
University	**Master**
Univ La Laguna	Astrophysics
Univ Complutense de Madrid & Univ Autónoma de Madrid	Astrophysics
Univ Barcelona	Astrophysics, Particle Physics and Cosmology

6.1.9 *Dpto. d'Astronomia i Meteorologia (DAM). Universidad de Barcelona*

DAM is constituted by 22 permanent researchers, 10 postdocs and more than 30 Ph.D. students. All astrophysicists belong to a single group in the Generalitat de Catalunya research groups catalog. Astronomers and astrophysicists of the DAM are members of the *Institut d'Estudis Espacials de Catalunya* (**IEEC**).

Research topics include:

1) Supernovae and the evolution of the Universe
2) Formation and Evolution of Galaxies and their clusters
3) Microquasars and High-Energy Astrophysics
4) Space Astronomy: kinematics and structure of the Galaxy
5) Last stages of Stellar Evolution and Chemical Evolution of the Galaxy
6) Interstellar medium: Star formation regions
7) Solar-Terrestrial Physics and Space Weather
8) Astronomical Instruments and Robotic Astronomical Observation
9) Astronomical Images Treatment

Researchers of the DAM belong to the Supernova European Collaboration, a European Training Network.

6.1.10 *Dpto. Astrofísica. Universidad La Laguna (ULL)*

The Department of Astrophysics of *Universidad de La Laguna* has a very close collaboration with the *Instituto de Astrofísica de Canarias*, sharing the research, education and instrumentation areas. Out of the 25 members of the department, a large fraction of ULL researchers are also members of the IAC. For more details see the IAC section.

6.1.11 *Universidad de Valencia*

The *Departamento d'Astronomia i Astrofísica* of the *Universidad de Valencia* is composed of 19 permanent positions, 3 postdoc researchers, and 6 Ph.D. students. Research topics include:

1) Cosmology: evolution of galaxies and cosmic microwave background
2) Relativistic Astrophysics
3) Astronomy and Space Science: high-energy astrophysics and astronomical instrumentation
4) Radioastronomy: galactic and extragalactic radioastronomy, techniques

The Astronomy and Space Science Group (**GACE**) is a research group on astrophysics belonging to the *Instituto de Ciencia de los Materiales* (**ICMUV**) in the

University of Valencia. The GACE was created in 1990 from an investigation field in the astronomy and astrophysics department of the university. The main research topics are the development of high-energy astrophysics instrumentation for spatial vehicles and the study of X and Gamma emitter astronomic sources, both from ground and spatial platforms.

The Universidad de Valencia Astronomical Observatory operates as an independent unit and is formed by 6 researchers. It makes use of a robotic 0.6m telescope for scientific purposes at the *Centro Astronómico del Alto Turia* (**CAAT**).

6.1.12 *Universidad Complutense de Madrid (UCM) / Universidad Autónoma de Madrid (UAM)*

The UCM Astrophysics group is constituted by 9 permanent positions, 7 postdocs and 10 Ph.D. students. They belong to three research groups recognized in the UCM research groups catalog.

The UCM Astrophysics group operates the *Observatorio Astronómico de la UCM*, mainly dedicated to educational activities.

Research topics include: Star-forming galaxies, stellar populations of early-type galaxies, Cool stars and stellar activity and astronomical instrumentation.

The UAM Astrophysics group hosts 9 senior researchers and several Ph.D. students. Research topics include theoretical and numerical cosmology, extragalactic astrophysics, star formation, active stars and exo-planets.

6.2 The Spanish Astronomy @ Main European Organisations

As is expected from a full member of the European Union, Spain is a member of all the main European organisations.

6.2.1 The ESA membership

Spain is one of the 17 full members of the European Space Agency. The funding for the Spanish membership to ESA comes through projects allocated by MEC. In 2004, Spain contributed with 122.6 million euros, which represents 4.85% of the total budget. In 2005, 141 Spanish citizens out of 1,904 were directly working for ESA.

The Spanish representation at the ESA decisional boards are shown in the following table:

@ ESA Boards	
ESA BOARD NAME	**APPOINTING INSTITUTION**
Ministerial Level Council	*Ministerio de Industria, Turismo y Commercio*
Council:	*Ministerio de Industria, Turismo y Commercio*
SPC	*Ministerio de Industria, Turismo y Commercio*

The Centre for the Development of Industrial Technology (*Centro para el Desarrollo Tecnológico e Industrial,* **CDTI**), a Spanish public organisation, manages and pursues the achievement of industrial contracts with a high technological content by Spanish companies generated within the framework of different national and European organisations. These include the European Space Agency (ESA), the European Laboratory for Particle Physics (CERN), the European Synchrotron Radiation Facility (ESRF), Hispasat, Eumetsat and Spainsat.
CDTI acts as the Spanish delegation to ESA, and is responsible for the follow-up to the participation of Spanish industry in European space programmes. CDTI has the objective to help Spanish companies to increase the technological profile of said companies. Central headquarters of CDTI is in Madrid.

CDTI has a Directorate of Aerospace Programs that includes Aeronautics, ESA programmes and Returns of scientific programmes and large facilities.

6.2.2 The ESO membership

Since it was created in 1962, the Spanish astronomical community aimed to become a member of ESO. However, the large membership fee of more than 50 million euros and the need of funds for internal developments delayed the process until now.

The incorporation of Spain into ESO has been promoted by the Spanish Astronomical Society (*Sociedad Española de Astronomía*, **SEA**) since 1996 and was officially recommended by the *Comisión Nacional de Astronomía* (**CNA**) to the Ministry in March 2003. Finally, the current **Plan Nacional I+D+i** for 2004 - 2007 considered it as a top priority objective.
During 2004 and 2005, the negotiations between ESO and Spain progressed and ESO's Council approved the admission of Spain at its 107th meeting held in Garching on 7 and 8 December 2005.
In February 2006, the Spanish Minister of Education and Science and the ESO director signed the agreement. 1 July 2006 was decided to be the official date for Spain to become an ESO full member. In this direction several decisions were made: Spanish astronomers are invited to the ESO Time Allocation Committees and other commissions, and more important, Spanish astronomers can apply for observing time with ESO facilities with the same policies as the other country members.
However, normal bureaucracies and changes in the Spanish Ministry of Education and Science are delaying the process once again. In a short time, Spain will become a full ESO member.
The member fee (66 million euros) will be paid as 49 million euros in cash and 17 million euros as in-kind contribution. The annual fee will be 10 million euros.

In the mean time, Spanish astronomers are already using ESO observatories on a regular basis. Plans are being made to provide access for the European astronomical community to the 10m GTC Spanish telescope.

The funding for the Spanish membership at ESO is directly provided by the Ministry of Education and Science (*Ministerio de Educatión y Ciencia*) that also appoints the deputies:

@ ESO Council	
POSITION	**APPOINTING INSTITUTION**
Political Member	*Ministerio de Educación y Ciencia*
Scientific Member	*Ministerio de Educación y Ciencia*

6.3 The Funding

The core funding

The Spanish research public funding system is based on these main resources:

- Government funds are provided directly to the public bodies to be used both for research and structures maintenance (personnel, buildings, etc…)
- Science funds to support projects
- EU funds for large infrastructures and research and training networks
- Regional funds, especially to cover the running costs of universities and regional consortia of research groups
- Private foundations

The integrative funding

The main way of funding research in Spain is by public calls issued by the ministers on funds that are not pre-allocated.

6.3.1 *Ministerio de Educación y Ciencia*

The primary national funding resource for research teams in Spain stems from the National Plan for Research, Development and Innovation, a 4-year plan which currently expires in 2007. Its total budget for 2005 was 300 million euros, 25 millions more than budgeted in 2004. The Plan received in 2005, 6,431 applications for a total number of 14,000 researchers (80% universities and 20% public bodies). In 2005, more than 3,300 requests were approved, with an average of 53% in the 1995-2005 periods.

There are a number of programmes devoted to specific R&D areas. The Astronomy & Astrophysics Programme (**PNAyA**) was created in 2000, with its main objectives being:

- Basic research in astronomy and astrophysics
- Design and development of astronomical instrumentation
- Exploitation of available facilities
- R&D in astronomy-related technologies

This is complemented by the National Space Programme, where an important ingredient is the development of scientific payloads for astronomy and Solar System missions, and their scientific data exploitation.

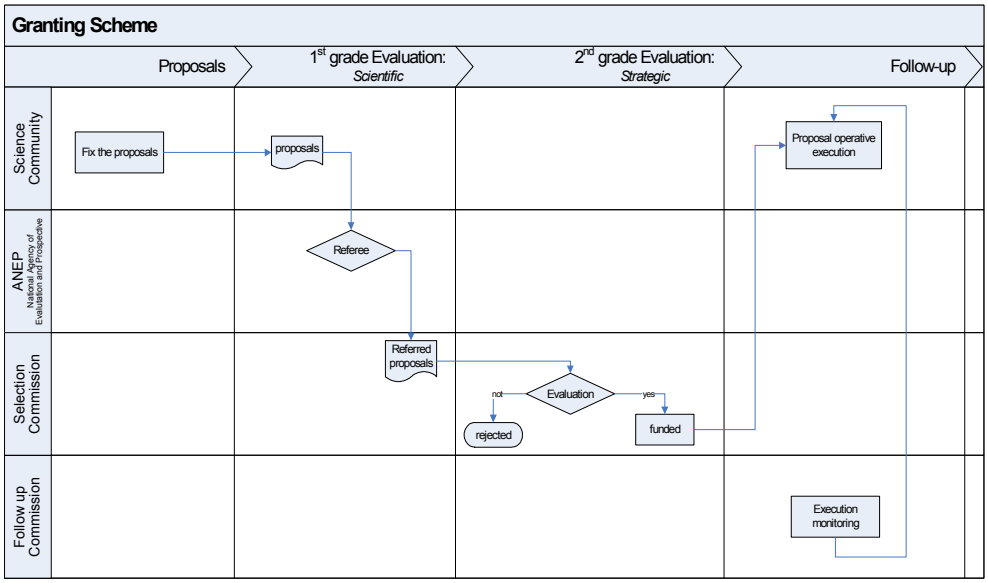
Since its creation in 2000, PNAyA's total available funding has been increasing from 3.5 million euros in 2005 to 6.3 million euros in 2006.

The National Plan, also, has a number of tools, which range from provision of funding for direct research costs, provision of Ph.D. fellowships and technical trainee contracts, provision of postdoctoral contracts at various levels and many others.

Normal projects (Categories A, B and C)

The most relevant tool is the 3-5 year projects, which often provide the largest financial contribution to astronomy groups. Project funding is assigned following strict peer-review evaluation and an overall ranking decided by a national programme board. The projects are classified and selected according to the following scheme:
It considers 3 years projects (Category B) and small start-up groups (Category A). Recently, a new subcategory has been introduced called Consolider type C projects that receive more funds and covers a 5 years period. Typically, each research group is funded by a normal PNAyA project.

The evaluation procedure is made up of two steps, as described in Figure 5. The first step is a scientific, blind evaluation by the ANEP (*Agencia Nacional de Evaluación de Proyectos*), an independent agency appointed by MEC, and after, by a panel that evaluates the priorities according to the national



plan. The average approved projects in the astronomy domain are about 30-40 (33 in 2006). A follow-up relaxed review and a critical review of critical projects are performed.

Procedure to evaluate applications

In the following table, a summary of normal projects during 2005 and 2006 are offered (the year 2000 is included as reference):

Summary of Normal Projects			
Year	Granted Projects	Total Budget (M€)	Ph.D. Fellowships
2000	23	3.2	n/a
2005	33	3.5	12
2006	33	6.3	16

In 2006, the Plan approved 3 A-projects, 28 B-projects and 2 C-projects.
With respect to the objectives of the projects, 24 were for basic research, 4 for design and development of instrumentation, 3 to exploit existing resources and 2 were for R&D technologies related to astronomy.

Barcons et al. (2002) studied the period of 2000, 2001, 2002 and concluded that, on average, the PNAyA is funding each senior astrophysicist with about 20,000 euros for three years period. This amount ranges from 5,000 to 30,000 euros. The amount of funds managed by the national space program is more irregular, but significantly higher.

The MEC's current policy foresees an increase in the amount of funds to allocate, particularly, for large projects.

Special Actions

There is a three deadlines call to fund smaller projects, well-defined actions or networks. MEC's response is usually fast, in about 4 months. Ten percent of the total funds for smaller projects funds national and international scientific meetings, instrument overruns, etc.

Consolider-Ingenio 2010 projects

This category was created in 2005 for large consolidated groups with large projects (usually more than 50 people and 1 M€/year/project). This category covers periods of five years.
As a result of the first call in 2005, a grand total of 15 Consolder-Ingenio 2010 projects were approved. Only one astronomy project, for the early scientific exploitation of the Spanish 10m telescope GTC, was granted. This project is coordinated by the IAC, and joins efforts of almost one hundred Spanish astrophysicists belonging to more than ten institutions.

Large infrastructures

Infrastructures, and particularly what these days are called "singular scientific infrastructures" (which for astronomy means telescopes or similar), are funded through independent channels and budgeted separately. An "Advisory Committee on Singular Infrastructures" proposes, evaluates and oversees these at the national level. A plan to study and eventually implement new

infrastructures within the 2005-2020 timeframe, in which astronomy will likely have a very relevant role indeed, is being now drafted by the Ministry of Education and Science in consultation with the scientists and the regional governments among other possible partners.

Ph.D. fellowship program

Grants for Ph.D. positions related to projects are issued as extra funds. Typically, astrophysics receives 14-15 Ph.D. grants per year and space programs receive 10 Ph.D. grants per year. Projects' PIs are selected by the funding ministry.

Torres Quevedo program

The Torres Quevedo program provides private enterprises the opportunity to engage technicians in R&D projects.

6.3.2 EU funds

Memberships to EU calls as the Research Framework Programs (FP) are performed by single institutes and agencies or joint-ventures between them.

The EU structural funds are administrated by the Spanish government through MEC; they are allocated in the budget of the programs themselves.

Spanish institutions participate in several successful EU Research and Training Networks that are granted substantial funds (more than half a million euros on average per network).

6.3.3 The regional funds

Regional governments have a role in influencing research not only by administrating the complementary EU structural funds but also by funding, with their own funds, programs that involve the research infrastructures present in their own jurisdictions and/or by promoting consortiums' agreements.

In Spain, there are several autonomous governments that are especially active in astronomy. The *Comunidad de Madrid* (CAM) issues periodically, since the ninety's, its *Plan de Ciencia y Tecnología* (**PRICIT**). In 2005, the IV PRICIT was presented with a total budget of 225 million euros. For the first time, the area of astronomy was qualified as a priority line of research for Madrid. The IV

PRICIT granted two programs for R&D activities covering the 2006-2009 period and was shared by the Madrid research groups in astrophysics. ASTROCAM, with a budget of 0.9 million euros, is coordinated by DAMIR (CSIC) and includes teams from CSIC, *Universidad Complutense de Madrid*, *Universidad Autónoma de Madrid*, *Universidad Politécnica de Madrid*, *Universidad Europea de Madrid* and ESAC. Its main objective is to promote astrophysics network of the CAM. ASTRID, with a budget of 0.65 million euros, is coordinated by the UCM and includes teams from *Universidad Complutense de Madrid*, *Universidad Autónoma de Madrid*, *Universidad Politécnica de Madrid*, INTA, LAEFF, ESAC and several technological companies. Its main objective is to promote the astronomical instrumentation.

The *Junta de Andalucía* is starting in 2006, and is similar to PRICIT, with four astronomy programs selected, but the granted funds have yet to be decided. The *Generalitat de Catalunya* is also very active in promoting R&D activities, creating research positions and funding several astronomy-related institutions.

Other autonomous governments with active funding in the area of astronomy are *Comunidad Valenciana* and *Canarias*. Most of these autonomous governments have their own Ph.D. fellowship programs that implies about 10-15 fellowships for Astronomy in each region.

6.3.4 Private funds

Unfortunately, private funds in Spain do not play the important role that they do in other western countries. Every year a few institutions such as the *Fundación Ramón Areces*, *Flores-Valles S.A.* in collaboration with the *Universidad Complutense de Madrid*, *Iberdrola* and *Banco de Santander* offer fellowships for visiting professors and Ph.D. students or similar in the fields of physics, chemistry and/or biology. Usually, a few of them are for activities related to astronomy and astrophysics.

Companies & Astronomy

Astronomy and the industrial sectors collaborate on technological projects by building telescopes, electronics, cameras and satellite instruments. In space sciences, the industry has a long tradition of collaboration in astronomy projects. For ground-based astronomy, the development of the Spanish 10m GTC telescope is promoting a fast growing participation of the industrial sector. Hopefully, as Spain becomes a full member of ESO, the industrial sector will also benefit in this new market.

6.4 The Personnel

Universities

Several modifications in the university laws and their corresponding transition periods during the last decades, have introduced some complexity in the way universities manage personnel.
Currently, research staff positions in universities are divided into two different levels: *Catedrático* (Full Professor) and *Profesor Titular* (Associate Professor/Lecturer). *Profesor Contratado Doctor* is a new and third permanent position with a lower salary and category introduced by the last Spanish Law for Organisation of the University (*Ley Orgánica de Universidades*, **LOU**, January 2002). A minimum number (usually 12), the result of the sum of *Catedráticos* and *Profesores Titulares*, is needed to create a university department. Each department has the responsibility of teaching and performing research in a given area of knowledge (área de conocimiento). Permanent positions are supported by *Profesores Ayudantes* (Teaching Assistants) and *Profesores Asociados* (Collaborators) with temporary contracts (three or five years in the case of *Ayudantes*).

University Personnel		(2005)
Catedrático	Permanent	14
Profesor Titular	Permanent	51
Profesor Contratado Doctor	Indefinite contract	
Profesor Ayudante	Five years contract	
Contratado Postdoctoral	Variable contract or fellowship	
Estudiante de tesis	Fellowship	

Note: In 2005, there were still only 14 Catedráticos in the area of Astronomy and Astrophysics.

LOU introduced a new mechanism to select permanent positions. Universities employ professors when a position is available and select from a national list of qualified people. Candidates for professor positions, in fact, must have already passed an episodic national contest (called *Habilitación*) to obtain their qualification of Professor. *Habilitación* requires three oral exams: one for curriculum, teaching project and research project, the second for teaching a section of a given subject, and the last for a research project. A limited amount of positions are available, but, generally, these are more than adequate. The qualification obtained is for life. Currently, the professors' average age is around 36 years.

Long-term (5 years) temporary positions for TeachingAassistants can also be opened. In this case, universities also choose from a national list of qualified people. Candidates for the Teaching Assistant positions, in fact, must have already passed an episodic national public competition (called Acreditación) to obtain their qualifications. Acreditación can be obtained from the national government through ANECA (*Agencia Nacional de Evaluación de la Calidad y Acreditación*), an agency created for this purpose, or from autonomous governments. It does not require any exam, just an evaluation of the curriculum vitae. A limited amount of positions are available, but, generally, these are more than adequate. The qualification obtained lasts for life.

Ph.D. degrees are awarded by universities, which select students on curricula evaluations. Some universities offer their own Fellowship programs, being as equal as the ones offered by the ministry.

It is worth noting that the Spanish government is preparing a new university law that will be introduced during 2007 and that will modify again the figures and the selection process for university positions.

Research bodies

Scientific positions in public bodies come from CSIC positions or autonomous government positions. In the case of CSIC researchers, positions are subdivided into three levels shown in the table below. The number of new entry level positions is decided by the Council of Ministers. Then, the selection is performed by an ad hoc committee. The selection is based on two oral exams. The candidates at the highest two levels are selected by curricula evaluation or by an internal promotion.

CSIC Personnel in Astronomy & Astrophysics		(2005)
Profesor de Investigación (PI)	Permanent staff	7
Investigador Científico (IC)	Permanent staff	9
Científico Titular (CT)	Permanent staff	22
Titulado Superior Especializado	Variable contract	n/a
Titulado Técnico Especializado	Variable contract	n/a
Ayudante de Investigación	Variable contract	n/a
Auxiliar de Investigación	Variable contract	n/a

In 2003, CSIC consisted of 441 *Profesores de Investigación*, 577 *Investigadores Científicos* and 1,334 *Científicos Titulares*. In 2005, in the area of astronomy and astrophysics, there were still only 7 *Profesores de Investigación*.
CSIC has its own Ph.D. fellowship program (I3P program) that implies about 10-15 fellowships in astronomy each year.

In the case of autonomous government positions, there are no homogeneity and each region has its own scale and procedure.

Ramón y Cajal & Juan de la Cierva programs / Postdoctoral positions

Postdoc positions can be opened by universities and research institutes to do research on targeted projects. Grants are related to the projects. Long-term postdocs positions (open to foreign Ph.D. also) can be issued (5 years contract). The average number of positions issued in the astrophysics domain is about 10 per year.

The Ministry of Education and Science (MEC) created in 2001 the *Ramón y Cajal* (**RyC**) program with the aim of attracting high-level scientists (no matter the country) to Spain. In the period 2001-2004, the RyC program had offered 2,300 contracts. It offers an excellent salary and funds for research during a five years period. The researcher is supposed to develop an independent line of research. The RyC program plays the role of the tenure-track positions in other countries. At the end of the RyC period, the host institution is expected to incorporate the researcher.
In the astronomy and astrophysics area, a total of 67 RyC positions have been approved, 20 during the first year in 2001 and 11 during 2002.

The *Juan de la Cierva* program was created in 2004 by the MEC to offer an opportunity to junior postdoctoral researchers. The total offer each year is 350 contracts. Candidates must have had their Ph.D.s for less than 3 years or are in their last year as Ph.D. students. The program covers a three years period and does not offer any extra budget for support. A *Juan de la Cierva* researcher is supposed to join a research group under the supervision of a senior researcher.

Chapter 7

The Management of British Astrophysics

An overview of the organisation of the research system in the United Kingdom

The Office of Science and Innovation (**OSI**), formerly the Office of Science and Technology (OST), forms part of the Department of Trade and Industry (DTI). OSI supports the government in developing and implementing its domestic and foreign policies for science and innovation. OSI is also responsible for the allocation of the Science Budget into research via the eight UK Research Councils.

The eight UK Research Councils were established under Royal Charter and are as follows:

- Biotechnology & Biological Science Research Council (BBSRC);
- Council for the Central Laboratory of the Research Councils (CCLRC);
- Engineering & Physical Sciences Research Council (EPSRC);
- Economic & Social Research Council (ESRC);
- Medical Research Council (MRC);
- Natural Environment Research Council (NERC);
- Particle Physics & Astronomy Research Council (PPARC);
- Arts and Humanities Research Council (AHRC)

7.1 The Players of UK Astronomy and Astrophysics

The policy making organisations

7.1.1 PPARC Particle Physics and Astronomy Research Council

The Particle Physics and Astronomy Research Council (**PPARC**) is the UK's strategic science investment agency. It funds research, education and public understanding in four broad areas of science - particle physics, astronomy, cosmology and space science. PPARC is an independent organisation (a non-Departmental Public Body), established in 1994 by Royal Charter (revised supplemental Charter 2003), and is one of eight Research Councils in the UK run under the direction of the Office of Science and Innovation.

PPARC receives an annual budget from OSI and in turn provides research grants and studentships to scientists in British universities, gives researchers access to world-class facilities and funds the UK membership to international bodies such as the European Organisation for Nuclear Research, (CERN), the European Space Agency (ESA) and the European Southern Observatory (ESO). It also contributes money for the UK telescopes overseas on La Palma, Hawaii, Australia and in Chile, the UK Astronomy Technology Centre at the Royal Observatory, Edinburgh and the MERLIN/VLBI National Facility.

PPARC comprises an administration headquarters in Swindon plus three scientific institutions: the United Kingdom Astronomy Technology Centre (UK ATC) in Edinburgh, the Isaac Newton Group of Telescopes on La Palma in the Canary Islands and the Joint Astronomy Centre in Hawaii.

PPARC's Council is the main ruling body. The Council is the key strategy-making, policy-forming and priority-setting body, receiving recommendations and advice from the Executive and the advisory bodies it has established. The Council has delegated responsibility for management of its programme to the Executive under the Chief Executive. PPARC's Science Committee advises PPARC's Council and Executive on all aspects of the PPARC science programme. In particular, it is charged with developing a long-term strategy for sustaining and enhancing the international excellence of the programme. The diagram below illustrates PPARC's management structure:

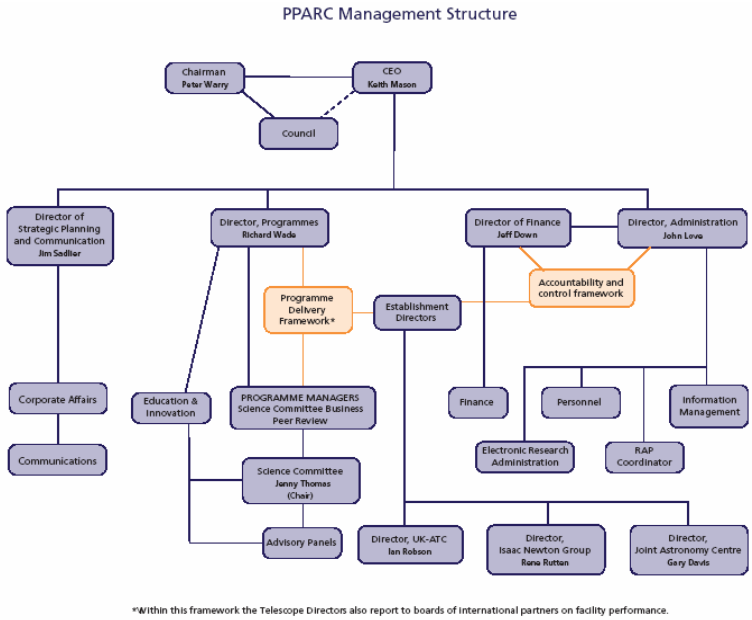


Figure 1- Organisation Chart showing PPARC Management Structure. (PPARC website: http://www.pparc.ac.uk/Ap/Oc/Orgno/MgmentStruct.pdf)

PPARC interactions with other agencies

Some PPARC funded research and technology development overlaps with the work of a number of the other UK research councils, government departments and industry. Where synergies arise, PPARC actively seeks to collaborate with these organisations:

PPARC & other Research Councils

The UK's eight Research Councils have formed a strategic partnership called Research Councils UK (RCUK). This provides a framework for the Research Councils to work together to champion research, training and innovation in the areas they support.

PPARC & BNSC

PPARC is one of the 11 funding partners to the British National Space Centre. Other funding partners include Natural Environment Research Council (NERC) and the Council for the Central Laboratory of the Research Councils (CCLRC).

PPARC & Royal Astronomical Society

A member in common with the RAS and PPARC Councils acts as a point of contact for interactions between the two organisations. PPARC also jointly sponsors the National Astronomy Meetings and an annual astronomy prize.

PPARC & Royal Society

The Royal Society's main interactions are via DTI and OSI. However, PPARC often plays an active role in the Royal Society's annual Summer Exhibition.

PPARC & other government departments/organisations

PPARC has concordats with the Ministry of Defence and the Department of Health and, occasionally, they make funding available for certain research projects.

The Foreign and Commonwealth Office's (FCO) Science and Technology Unit provides extensive advice on issues affecting international collaborations in support of the PPARC scientific programme. This role extends, through the S&T Network in British Embassies working with PPARC staff, to facilitating links and aiding the development of new collaborative opportunities for the PPARC research and industrial communities overseas. UK industry also contributes to astronomical research via collaborative research grants.

7.1.2 CCLRC Council for the Central Laboratory of the Research Councils

CCLRC, one of the eight Research Councils, operates the Rutherford Appleton Laboratory in Oxfordshire, the Daresbury Laboratory in Cheshire and the Chilbolton Observatory in Hampshire. These world-class institutions support the research community by providing access to advanced facilities and an extensive scientific and technical expertise. The CCLRC receives direct funding from the Office of Science and Innovation for providing, operating, maintaining, developing and upgrading its large scale facilities and their instrumentation. A proportion of CCLRC's income is derived from the other Research Councils via Service Level Agreements. The balance of CCLRC's income comes from contracts and agreements with government departments, the European Commission, universities and industry.

The Royal Society

The Royal Society is a leading independent scientific academy of the UK dedicated to promoting excellence in science. The Society plays an influential role in national and international science policy and supports developments in science engineering and technology in a wide range of ways. The Royal Society receives approximately £30 million from the Department of Trade and Industry as Parliamentary Grant-In-Aid. A further £10 million of funding is received from private sources, such as industry and endowments. Of this £40 million, approximately 80% is spent by the Royal Society on supporting excellent scientists through a variety of grants and fellowships; astronomers are eligible to receive this funding.

7.1.3

The Royal Astronomical Society

The Royal Astronomical Society is a leading professional body for UK astronomy & astrophysics, geophysics, solar and solar-terrestrial physics, and planetary sciences. The RAS organises scientific meetings, publishes research and review journals. The Society also awards grants and prizes, supports educational activities and lobbies government.

British National Space Centre

The British National Space Centre is a voluntary partnership, formed from 11 government departments and Research Councils (including PPARC), to coordinate UK civil space activity. At the centre of UK's civil space policy, BNSC facilitates cooperation on the national and international level. By representing both academic and industrial interests, BNSC provides the UK space community with a strong voice in international negotiations. BNSC is funded by the partnership organisations.

The performing bodies

The Universities

Most astronomical research in the UK is undertaken within universities, either by research staff, Ph.D. students or those undertaking postgraduate fellowships. Most UK universities have Departments of Physics and Astronomy within their science faculties. These departments undertake research as well as teaching as part of their portfolio of activities. Studentships in astronomical research are also available. A survey conducted in 2003 indicated that there were 47 research organisations with PPARC research grants as of 1 November 2003.

Universities are also able to contribute directly to the research infrastructure by allocating funds received from the Science Research Investment Fund (SRIF) to areas of specific interest. For example, SRIF funding has been used by the Universities of Central Lancashire, Southampton, Nottingham, Keele, the Armagh Observatory in Northern Ireland and the Open University to form the UK SALT Consortium in order to participate in the South African Large Telescope. (The Science Research Investment Fund (SRIF) is a joint initiative by the Office of Science and Innovation and the Department for Education and Skills.)

The performing bodies can be found in the following tables below that show the list of universities/institutions that received PPARC research grants in Funding Year 2004/2005.

7.2 The British Astronomy @ Main International Organisations

The PPARC research objectives are shared with other major scientific nations, and as such the Council collaborates with other nations in order to mitigate the high capital costs of facilities. Various agreements are in place to regulate annual contributions and the management of the various facilities. Details of some of these contributions and agreements are below:

Annual Infrastructure Investment

Year	Investment in PPARC Establishment ATC; La Palma; JAC	Investment via International Subscriptions ATT, CERN, Gemini, ESA, ESO	Investment via Grants
2004/05	3.0	84.0	7.5
2004/04	5.1	80.8	8.2
2002/04	4.4	70.9	7.5

International Collaboration Agreements

Institution	2005 (k£)	2004 (k£)
European Incoherent Scatter Facility (EISACT)	510	572
Anglo Australian Telescope (AAT)	1,475	1,516
European Space Agency (ESA)	55,191	46,886
European Organisation for Nuclear Researches (CERN)	75,671	73,056
European Science Foundation (ESF)	88	82
European Southern Observatory (ESO)	17,434	15,033
Total	***150,369***	***137,145***

In addition, PPARC collaborates with Dutch and Canadian partners in respect to the James Clerk Maxwell Telescope (JCMT) on Hawaii. The UK and Dutch are also partners in respect to the operation of telescopes on La Palma. A partnership of seven agencies from the US, UK, Canada, Australia, Brazil, Argentina and Chile fund the Gemini Observatory, which is operated, on the

partnership's behalf, by the American University Research Association (AURA).

Responsibility for appointing UK delegates to these bodies generally falls to PPARC; however, in some cases such as the ESA Council, appointments are made at the government level through DTI/OSI.

7.2.1 The ESA membership

The funding for the UK membership to ESA is covered by an annual subscription from PPARC. UK representation at the ESA decisional boards is as follows:

@ ESA Boards	
ESA BOARD NAME	**APPOINTING INSTITUTION**
Ministerial Level Council	Lord Sainsbury of Turville, Parliamentary Under Secretary of State for Science and Innovation
Council:	Professor K Mason, Chief Executive Officer, PPARC Mr C Hicks, British National Space Centre Ms P Freedman, British National Space Centre Mr R Sivalingum, British National Space Centre
SPC	Professor R Wade, PPARC Dr D Parker, PPARC Professor M Griffin, Cardiff University

7.2.2 The ESO membership

In July 2002, the UK became the tenth member of ESO. Funding is covered by an annual subscription from PPARC together with the contribution of the UK's 4.2-metre Visible and Infrared Survey Telescope for Astronomy (VISTA). The UK has representation on the following ESO Boards:

@ ESO Councils	
POSITION	**APPOINTING INSTITUTION**
Council	Professor G Gilmore, University of Cambridge Professor R. Wade, PPARC (currently ESO Council President)
ESO Technical Scienfitic Committee	Professor R Hills, University of Cambridge Dr P Roche, University of Oxford

7.2.3 The Gemini Observatory membership

The Gemini Observatory is owned by a partnership of seven agencies representing the US, UK, Canada, Australia, Brazil, Argentina and Chile and operated by the American University Research Association (AURA). The UK has approximately 23% share in Gemini and has membership on the following Gemini Boards:

@ Gemini Councils	
POSITION	**APPOINTING INSTITUTION**
Board	Mr G Brooks, PPARC
Financial Committee	Mr G Brooks, PPARC Mr J Down, PPARC

7.2.4 The Anglo-Australian Observatory membership

The Observatory is funded equally by the Australian and British governments under the Anglo-Australian Telescope agreement. The UK has representation on the AAT Board as follows:

@ Anglo-Australian Councils	
POSITION	**APPOINTING INSTITUTION**
Board	Dr C Vincent, PPARC Dr S Warren, PPARC

7.3 The Funding

The main sources of astronomy funding in the UK is via the Particle Physics and Astronomy Research Council (PPARC) and the Higher Education Funding Councils (**HEFC**).

The funding making organisations

7.3.1 *Particle Physics and Astronomy Research Council*

The UK government money funds the majority of UK research in astronomy. It is the responsibility of PPARC to administer and allocate these funds via research grants, fellowships, studentships and international subscriptions. PPARC's remittance covers both ground and space-based astronomy. A number of other organisations are also actively involved in UK astronomy in various ways. More details about the organisations are given below:
PPARC is the UK's strategic science investment agency and is, therefore, responsible for the direction, co-ordination and funding of UK research in particle physics, astronomy, cosmology and space science. PPARC's Council is the key strategy-making, policy-forming and priority-setting body. The Council's key objectives and its broad, long-term strategies for achieving them, are enshrined in its Strategic Plan, which it revises every few years on the basis of recommendations from its advisory bodies and the PPARC Executive. These long-term strategies are translated into more immediate targets in the PPARC Operating Plan, which is produced each year.
The Science Committee advises PPARC's Council and Executive on all aspects of the PPARC science programme. In particular, it is charged with developing a long-term strategy for sustaining and enhancing the international excellence of the programme.
Science Committee maintains a science road map, setting out and prioritising the major project opportunities likely to arise within the next 10 years or so, and invites and assesses proposals for major new projects.

Evaluating Procedures

The first task of allocating funds between the main areas falls to Council, PPARC's ruling body. PPARC's Council, which consists of the Chair, the Chief Executive (and Deputy Chair) and between 10 and 18 other members. Membership is drawn from the academic and industrial communities; all members are appointed ad hominem by the Minister for Science. The purpose of the Council is to pursue the objects set out in section 2 of the Council's Charter. The Council is the key strategy-making, policy-forming and priority-setting body, receiving recommendations and advice from the Executive and the advisory bodies it has established. Council has delegated responsibility for management of its programme to the Executive under the Chief Executive. Parliament also exercises its authority and influence on PPARC through a

number of Select Committees and the Parliamentary Commissioner for Administration.

For each of its key objectives, PPARC has appointed an advisory committee of experts, drawn mainly from universities and industry, to help it decide how to achieve these objectives and on which projects to spend the money. In deciding the membership of its advisory committees, PPARC invites nominations and seeks advice from Council members and others.
The majority of PPARC's budget (over 90% in 2002/03) goes to fund research in astronomy and particle physics. Advice on this is provided by PPARC's Science Committee, a body of senior astronomers and particle physicists from UK universities. It in turn is advised by four science advisory panels, each concerned with a particular area of astronomy or particle physics and composed of specialists in that field.
The Science Committee has first to consider how, in broad terms, money should be allocated to different types of activity. For example, research in astronomy and particle physics require large facilities, such as telescopes and particle colliders, which PPARC provides as a national resource for scientists to use. A key task for the Science Committee is, therefore, to recommend how much money should be spent on building and running these large facilities and how much should be spent on the research grants that enable science to be done with them and that also fund other activities, such as theoretical research and technology development.

The PPARC Science Road Map has been created to assist with planning a long-term investment strategy. The Roadmap considers the range of future scientific opportunities and options in a structured way and is built around nine key science questions, as follows:

- What is the universe made of and how does it evolve?
- What is the origin of mass?
- Are we alone in the universe?
- Why is there more matter than antimatter?
- How do galaxies, stars and planets form and evolve?
- Is there a unified theory of all particle interactions?
- What are the laws of physics in extreme conditions?
- How does the Sun affect the Earth?
- What are the origins and properties of the energetic particles reaching the Earth?

The Science Committee recommends which of the particular projects, put forward by UK scientists, should be funded. In the case of big investments, like telescopes and particle colliders, the Committee takes advice from its advisory panels on the scientific importance of the proposed project, on its technical feasibility and its cost. In the case of smaller grants, the assessment is delegated to specialist panels which review applications with the help of written comments from experts, often from overseas, and sometimes from

even more specialist visiting panels. All decisions about the scientific projects to be funded are made against a set of criteria, which essentially is as follows:

- How good is the science proposed - is the research in an area of current interest that is likely to advance our understanding of the Universe?
- How credible is the proposal - is what is proposed likely to be achievable and do the applicants have the necessary experience and expertise?
- Are all the funds requested really needed? Could it be done for less?
- Will the research be a cost effective use of funds?

Once the funds have been awarded, PPARC requires information from the grant-holders on what the award has been spent on and how their work has progressed. In the case of the smaller grants, the grant-holders must send a report at the end of their grant. These are assessed by experts unconnected with the project. In the case of larger grants, PPARC requests progress reports and, in many cases, sets up a committee of experts (a steering committee) to monitor progress and to give advise on whether the project is proceeding satisfactorily or not.
Each year, PPARC accounts for the way it has spent its budget through the submission of audited accounts and an Annual Report on its activities which is laid before Parliament.

PPARC receives a budget of around £220 million a year from the government. More details about PPARC's research and other funding for FY04/05 are given below:

Research Grants		
Domain	**2005 (k£)**	**2004 (k£)**
Astronomy	36,323	35,741
Particle Physics	22,186	17,946
E-Science	4,193	2,553
PPARC Industrial Programme Support Scheme (PIPSS)	632	711
Joint Research Equipment (JREI)	-	50
Joint Infrastructure Fund (JIF)	15,995	9,740
Total	***79,329***	***66,741***

Other Research Grants

Action	2005 (k£)	2004 (k£)
Research and Research Support	35,475	34,275
Postgraduate Training Awards, Fellowships	15,036	13,202
Total	*50,511*	*47,477*

Summary of Research Grants to Universities in the FY ending 31 March 2005

Institution	Astronomy	Particle Physics	PIPSS, ROPA, Faraday & ITF	eF	E-Science	Total
Ccirc	885	15			34	904
Birmingham	1,268	1,266			94	2,628
Bristol	138	427			78	644
Cambridge	6,170	1,952		45	268	7,635
Cardiff	1,606	482	13		32	2,143
City				13		13
Durham	1,932	929	117	678	19	3,674
Edinburgh	895	458		5,531	348	7,233
Exeter	191					191
Glasgow	109	2,867	132		275	3,382
Heriott-Watt		24		31	10	65
Hertfordshire	295					295
Imperial College, London	2,064	2,352	172	16	347	4,952

continues from the previous table						
Kings College London		126				126
Lancaster	380	587	101		184	1,252
Leeds	315	656			36	1,073
Leicester	3,668		6		892	4,565
Liverpool		1,760	30	120	8	1,917
Liverpool John Moores	635				35	689
Manchester	5,798	1,077	27	6	333	7,241
Nottingham	210		36			246
Oxford	1,388	3,393	130	62	204	5,178
Plymouth		24				24
Portsmouth	54					54
Queen Mary, University of London	623	1,215	56	10,790	152	12,835
Queens University, Belfast	275		26		19	320
Royal Halloway		552			14	566
Sheffield	622	717	25	287	20	1,671
Southampton						
St. Andrew's	649					649
Sussex	472	455	20	18		966
UW Swansea		27				27
University College London	4,939	917	94		258	6,239
Warwick	154	247	19			420
Open	806					806
UW Aberystwyth	385					385
Kent	370	3				373
Brunel		258	62		21	341
Keele						
Central Lancashire	127					127
Armagh Observatory	119					119
Cern			119			119
Strathclyde	26		77			104
Natural History Museum	101					101
Bath	85					85
Birkbeck College	1				52	53
York						
Surrey			21			21
Keele	**155**					155
Newcastel						1
TOTAL	**38,645**	**22,230**	**1,326**	**17,555**	**3,762**	**83,518**

7.3.2 OSI - Office of Science and Innovation

The Office of Science and Innovation provides targeted funds for technology development and investment in large infrastructure, eg. Basic Technology Fund. This heading also aligns to some extent with HEFC allocations to Higher Education Institution (HEI). However, their funding is determined by formulae rather than within a competitive call.

7.3.3 High Educational Funding Council for England

The majority of the funding is provided by the Higher Education Funding Council for England with smaller amounts being provided by the Councils for Scotland and Wales. In 2005-06, HEFCE distributed £1,251 million to fund research. HEFCE provides funding to support the research infrastructure, including the salaries of permanent academic staff, premises, libraries and central computing costs. These funds are spent at the institutions' discretion.

HEFCE funding aims to provide institutions with:

- a base from which to undertake research commissioned by other funding sources;
- flexibility to react to emerging priorities and new fields of enquiry;
- facilities to train new researchers;
- capacity to undertake ground-breaking basic research which is often the foundation of strategic and applied work funded by other sponsors.

Evaluation Procedures

The funding to HEI's is allocated using formulae which takes into account various factors, including number of students, amount and quality of research. The grants are awarded in the form of 'block grants' which the HEI's can spend according to their own priorities but within the HEFCE guidelines.

7.3.4 EU funds

EU funding can be obtained by the UK HEIs via European programs, such as ERDF or the 6th Framework Programme (2002-2006). For example, the former type of funding contributed towards the construction of the Liverpool Telescope, while the latter, for the construction of Extremely Large Telescope and Square Kilometre Array Design Studies.

7.3.5 The regional funds

Regional governments have a role in influencing research not only by administrating the complementary EU structural funds but, also, by funding with their own funds, programs that involve the research infrastructures present in their own jurisdictional territory and/or by promoting consortiums agreements

Funds are occasionally made available for astronomy from these sources. For example, with e-MERLIN, some funding towards this upgrade was made by the North-West Development Agency.

7.3.6 Private funds

Funds are occasionally made available for astronomy from private sources and donations. For example, Mr. Aldham Roberts contributed towards the Liverpool Telescope. Although the Faulkes telescopes are for educational use, the Dill Faulkes Educational Trust contributed towards the telescopes and enclosures, and the majority of the costs of establishing the programme.

The UK industrial system is made up, for the most part, of small and medium-sized businesses (SMEs) and these are responsible for about 70% of the production of goods and services. On the one hand, this is a factor that works for flexibility, but on the other, it does not allow a sufficient 'critical mass' for large-scale research projects.
UK industry also contributes to astronomical research via collaborative research grants.

7.3.7 The Royal Astronomical Society

The Royal Society spends around 80% of its £40 million budget on supporting excellent scientists through a variety of grants and fellowships. The Royal Astronomical Society awards grants in support of studies in astronomy and geophysics.

Evaluation procedures

The Royal Society's grants and fellowships are subject to peer review and are assessed on a competitive basis. The Royal Astronomical Society applications are assessed on a competitive basis, and successful proposals receive awards drawn from the Society's research and grants funds

7.4 The Personnel

PPARC Staff information

The average number of employees during the FY 04/05 was 299, excluding Council and Committee members, and consisted of the following:

The Average Number of PPARC Employees during the FY 04/05

Action	2005 (k£)	2004 (k£)
Science: Program Development and Management	198	200
Promotion of Science	12	12
Administrative Support	89	74
Total	***299***	***286***

Note: In this table there are 8 agency staff(14 in 2003/04), 7 Fixed Temporary Appointments (33 in 2003/04) and no staff on inward secondment (2 in 2003/04)

Research Grant Staff

In 2003, PPARC and NERC undertook a joint web-based survey of staff supported through their research grants. The survey provided important information about the size and nature of information, for example, in relation to the Concordat and Contract Research Career Staff management, and the Skills Training Fund recommended by the 2002 Roberts Review 'SET for Succes'.

All research organisations with current NERC and/or PPARC funding were asked to participate - a total of 95 research organisations, 47 of which held PPARC grants.

Questionnaires were returned from 42 of the 47 research organisations with PPARC research grants. The data presented by one institution has been excluded from this analysis because of irreconcilable discrepancies with the data. The figures used for analysis are based on returns from 41 institutions.

Key Findings:

Data was received for 814 staff. Of those:

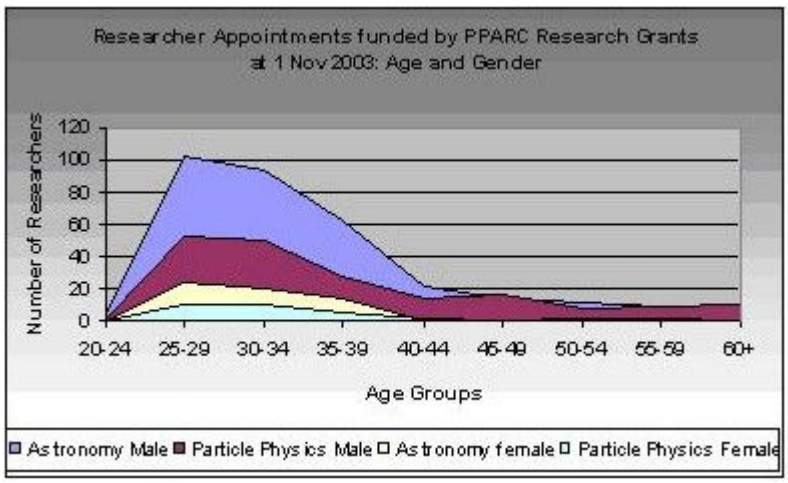
- 610 were postdoctoral researchers;
- 99 were technicians;
- 105 were 'Other' staff (this includes computer officers, project managers and specialist engineers).

- 71% of researchers were employed as RA1As or equivalent;
- 95% of researchers were employed on fixed term contracts (FTC);
- 84% of FTC researchers had been on fixed term contracts for less than 6 years in their current institution;
- 61% of researchers were under 35 years of age;
- 32% of technicians were on permanent contracts;
- 75% of technicians were aged 35 or over;
- 80% of 'Other' staff were on fixed term contracts.

Distribution of posts for which data was received						
	Astronomy		Particle Physics		Total	
	No	%	No	%	No	%
Researchers	387	77.6	223	70.8	610	74.9
Technicians	50	10.0	49	15.5	99	12.2
Other Staff	62	12.4	43	13.7	105	12.9
Total	499	100	315	100	814	100

Gender spread of Researchers across all Grades						
	Astronomy		Particle Physics		Total	
	No	*%*	*No*	*%*	*No*	*%*
Female	66	17	30	13	96	16
Male	321	83	191	87	514	84
Total	387	100	221	100	610	100

Age and Gender spread of Researchers across all Grades						
	Astronomy			Particle Physics		
Age	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**
20 - 24	4	1	5	2	0	2
25 - 29	102	25	127	52	10	62
30 - 34	93	20	113	50	10	60
35 - 39	62	14	76	28	6	34
40 - 44	21	1	22	15	2	17
45 - 49	15	1	16	17	0	17
50 - 54	12	1	13	8	2	10
55 - 59	9	2	11	9	0	9
60+	3	1	4	10	0	10
Total	321	66	387	193*	30	221



Gender spread of Technicians		
	No.	%
Female	10	10.1
Male	89	89.9
Total	99	100

Age spread of Technicians		
Age	Male	Female
20 - 24	4	1
25 - 29	102	25
30 - 34	93	20
35 - 39	62	14
40 - 44	21	1
45 - 49	15	1
50 - 54	12	1
55 - 59	9	2
60+	3	1
Total	321	66

Fellowships and Studentships

Fellowships: PPARC operates two main fellowships schemes - Postdoctoral Fellowships and Advanced Fellowships for researchers who do not yet have a permanent academic position.

Current Fellowships as of 31 March 2005

Institution	Postdoc	Advanced	Senior	Total
Birkbeck	0	0	0	0
Birgmingam	0	0	0	0
Bristol	0	1	1	2
Cambridge	10	3	1	14
Cardiff	1	1	0	2
City	0	1	0	1
Durham	2	4	3	9
Edimburgh	3	4	1	8
Exter	1	1	0	2
Glasgow	0	2	1	3
Heriott-Watt	0	1	0	1
Hertfordshire	0	1	0	1
Imperial College, London	3	4	4	11
Kings College London	1	0	1	2
Lancaster	0	1	1	2
Leeds	0	0	0	0
Leicester	1	3	0	4
Liverpool	3	1	2	6
Liverpool John Moores	0	1	1	2
Manchester	2	1	1	4
Nottingam	0	4	0	4
Oxford	4	0	3	7
Plymouth	0	0	0	0
Portsmouth	1	2	1	4
Queen Mary, University of London	0	2	1	3
Queens University, Belfast	1	0	0	1
Royal Halloway	1	1	0	2
Sheffield	1	1	1	3
Southampton	0	4	0	4
St. Andrew's	1	2	0	3
Sussex	1	3	1	5
UW Swansea	0	4	1	5
University College London	2	1	2	5
Warwick	0	1	1	2
TOTAL	**39**	**56**	**28**	**123**

Success rates of Applicants to the Postdoctoral and Advanced Fellowship schemes				
Application Round	**No. of Applications (Awards)**		**Success Rate**	
	Postdoctoral	Advanced	Postdoctoral	Advanced
2001/02	100 (14)	90 (13)	14%	14.4%
2002/03	129 (14)	114 (13)	10.9%	11.4%
2003/04	142 (14)	121 (13)	9.9%	10.7%
2004/05	175 (14)	155 (13)	8.0%	8.4%

Studentships: PPARC postgraduate studentships are awarded to enable promising scientists and engineers to continue training beyond a first degree.

Support at the Current Studentships as of 31 March 2005

Institution	Research	CASE	Faraday	E-Science	Total	Total (£)
Bath	1				1	15214
Birmingham	21	1		2	22	347,545
Bristol	16				18	308,22
Brunel	2			1	2	88,579
Cambridge	67				68	1,163,108
Central Lancashire	5			1	5	67,208
Durham	33			4	34	569,973
Edinburgh	17			1	21	388,816
Exeter	2	6		3	3	72,692
Glasgow	16				25	397,921
Heriott-Watt	1				1	10,559
Hertfordshire	8				8	142,857
Imperial College, London	38	2		2	42	786,254
Keele	4				4	51,516
Kant	3			1	4	39,406
Kings College London	3	1			3	65,681
Lancaster	6		1		8	164,901
Leeds	9				9	148,549
Leicester	17	2		1	18	302,25
Liverpool	17				19	342,839
Liverpool John Moores	5				5	85,671
Manchester	29			2	31	636,654
Newcastel	3		1		3	30,417
Nottingham	6				7	103,304
Open	9				9	139,23
Oxford	47	10		2	59	974,714
Plymouth	1				1	10,559
Portsmouth	4				4	73,9
Queen Mary, University of London	10	1		1	12	286,033
Royal Halloway	7				7	135,836
Sheffield	10				10	220,73
Southampton	15				15	253,213
St. Andrew's	14	1			15	219,594
Strathclyde	2				2	22,764
Sussex	15				15	218,768
UMIST	3				3	9,028
University College London	34	3			37	726,471
UW Aberystwyth	6				6	91,589
UW Cardiff	9	1		1	11	186,69
UW Swansea	5				5	89,44
Warwick	3	4			7	142,035
York	5				5	76,043

Table of Acronyms

AAO	*Anglo Australian Observatory*	United Kingdom/Int.
AHRC	*Arts and Humanities Research Councils*	United Kingdom
AIP	*Astrophysikalisches Institut Potsdam*	Germany
AMANDA	*Antartic Muon and Neutrino Detector Array*	International
ANR	*Agence Nationale de la Recherche*	France
APT	*Acatama Pathfinder Experiment*	International
ASI	*Agenzia Spaziale Italiana*	Italy
ASTRON	*The Netherland Foundation for Research in Astronomy*	The Netherlands
BBSRC	*Biotechnology & Biological Science Research Council*	United Kingdom
BMBF	*Bundesministerium für Bildung und Forschung*	Germany
BNSC	*British National Space Centre*	United Kingdom
BOREXINO	*A Real Time Detector for Low Energy Solar Neutrinos*	International
CAB	*Centro de Astrobiologia*	Spain
CAHA	*Centro Astronomico Hispano -Alemana*	Spain/Germany
CCLRC	*Council for the Central Laboratory of Research Councils*	United Kingdom
CEA	*Commissariat à l'Energie Atomique*	France
CERN	*Conseil Européen pour la Recherche Nucléaire*	International
CFHT	*Canada France Hawaii Telescope*	International
CHANDRA	*Chandra Xray Observatory*	U.S.A.
CNAP	*Conseil National des Astronomes et Physiciens*	France
CNES	*Centre National d'Etudes Spatiales*	France
CNR	*Consiglio Nazionale delle Ricerche*	Italy
CNRS	*Centre National de la Recherche Scientifique*	France
CRESST	*Cryogenic Rare Event Search with Superconducting Thermometer*	Spain
CSIC	*Consejo Superior de Investigaciones Cientificas*	Spain
DFG	*Deutsche Forschungsgemeinschaft*	Germany
DLR	*Deutsches Zentrum für Luft-und Raumfahrt*	Germany
DOT	*Dutch Open Telescope*	The Netherlands
DTI	*Departement of Trade and Industry*	United Kingdom
EDELWEISS	*Experience pour la Déetection bolométrique des WIMPs en site souterrain*	France/Germany
EGO	*European Gravitational Observatory*	France/Italy
ESA	*European Space Agency*	International
ESO	*European Southern Observatory*	International
GEO600	*Ground based gravitational wave experiment located in north germany*	Germany/Spain/UK
GTC	*Grande Telescopio de Canarias*	Spain
HEFCE	*High Educational Funding Council for England*	United Kingdom
HESS	*High Energy Stereoscopic System*	International
IAA	*Istituto de Fisica de Andalusia*	Spain
ICE	*Istituto de Ciencias del Espacio*	Spain
IFCA	*Istituto de Fisica de Cantabria*	Spain
IN2P3	*Institut National de Physique Nucléaire et de Physique des Particules*	France
INAF	*Istituto Nazionale di Astrofisica*	Italy

INFN	*Istituto Nazionale di Fisica Nucleare*	Italy
IGN	*Istituto Nacional Geografico*	Spain
ING	*Isaac Newton group of Telescope*	International
INGV	*Istituto Nazionale di Geofisica e Vulcanologia*	Italy
INSU	*Institut National des Sciences des l'Univers*	France
INTA	*Instituto Nacional de Técnica Aeroespacial*	Spain
JCMT	*James Clark Maxwell Telescope*	International
KAT	*Komitee für Astroteilchenphysik*	Germany
KNAW	*Koninklijke Nederlandse Akademie van Vetenschappen*	The Netherlands
LBT	*Large Binocular Telescope*	Germany/Italy/USA
LIGO	*Laser Interferometric Gravitational-Waves Observatory*	U.S.A.
LISA	*Laser Interferometer Space Antenna Gravitational Waves Observatory*	International
MAGIC	*Major Atmosphere Gamma ray Imaging telescope*	International
MEC	*Ministerio de Education y Cienca*	Spain
MPG	*Max Planck Gesellschaft*	Germany
MPI	*Max Planck Institut*	Germany
MRC	*Medical Research Council*	United Kingdom
MURST	*Ministero dell'Università e della Ricerca Scientifica e Tecnlogica*	Italy
NCA	*Netherlands Committee for Astronomy*	The Netherlands
NOVA	*Nederlance Onderzoeschool voor Astronomie*	The Netherlands
NWO	*Nederlandse Organisatie voor Wetenschappelijk Onderzoek*	The Netherlands
OAN	*Observatorio Astronomico National*	Spain
OCW	*Ministerie van Onderwijs, Cultuur en Wetenschap*	The Netherlands
OSI	*Office of Science and Innovation*	United Kingdom
OSN	*Observatorio de Sierra Nevada*	Spain
OST	*Office of Science and Technology*	United Kingdom
PNR	*Programma Nazionale di Astronomia*	Italy
PON	*Programma Operativo Nazionale*	Italy
POR	*Programma Operativo Regionale*	Italy
PPARC	*Particle Physics and Astronomy Research Council*	United Kingdom
PT-DESY	*Projektträger DESY*	Germany
RDS	*Rat Deutscher Sternwarten*	Germany
SALT	*South Africa Large Telescope*	International
SDSS II	*Sloan Digital Sky Survey II*	USA
SFTC	*Science Facilities and Technology Council*	UK
SNO	*Subdury Neutrino Observatory*	International
SRON	*Nederlands expertise-institut voor ruimteonderzoek*	The Netherlands
STELLA	*STELLar Activity*	Germany
Super Darn	*Super Dual Auroral Radar Network*	International
TBL	*Télescope Bernard Lyot*	France
THEMIS	*Télescope Héliographique pour l'Etude du Magnétisme et des InstabilitésSolaires*	France/Italy
TNG	*Telescopio Nazionale Galileo*	Italy/Spain
UMR	*Unité Mixte de Recherche*	France
VERITAS	*Very Energetic Radiation Imaging Array Telescope*	USA
WSRT	*Westerbork Synthesis Radio Telescope*	The Netherlands


ASTRONET
www.astronet-eu.org