

Institutions and organizations: Who does what?

Boeing (the Boeing Company): one of the largest aviation and space manufacturers in the world; its headquarters are located in Chicago, Illinois (USA).

Bologna Observatory: a research instrument for the Italian National Institute of Astrophysics (INAF: Istituto Nazionale di Astrofisica), under the oversight of the Italian Ministry of Research; its researchers are active in various areas of astrophysics, e.g. stars, galaxy structures, and evolution, simulation... in collaboration with many local, and international organizations.

Bull: a French company specializing in professional information technology, including high-performance computers (HPCs).

Centre d'étude spatiale des rayonnements (CESR): the Space Radiation Research Center, a space astrophysics laboratory based in Toulouse (France); a joint research unit, run by **CNRS** and Toulouse-III University, specializing in four main areas: space plasmas, planetary science, the high-energy (X-ray, gamma-ray) Universe, and the cold (infrared, submillimeter) Universe.

Centre de calcul recherche et technologie (CCRT): the Research and Technology Computing Center, a component in CEA's scientific computing complex, sited at Bruyères-le-Châtel (DAM-Île-de-France Center); it was commissioned to meet the requirements of CEA, and its partners, in terms of large-scale numerical simulations, and to promote scientific exchanges, and collaborations, in a context where access to high-performance numerical simulation has become one of the strategic considerations, with regard to competitiveness, for companies, and research organizations.

Centre de données astronomiques de Strasbourg (CDS): the Strasbourg Astronomical Data Center, which collects, and disseminates astronomical data; it hosts the world reference database serving for the identification of astronomical objects.

Centre national d'études spatiales (CNES): the French National Space Research Center, set up as a public-sector establishment of industrial and commercial character (EPIC), charged with defining French space policy within the European Union, as submitted to national government, and with its implementation. To that end, it "invents" the space systems of the future, ensures mastery of the entire range of space technologies, and guarantees France's independent access to space.

Centre national de la recherche scientifique (CNRS): a public-sector establishment of scientific and technological character, carrying out its research activity in all fields of knowledge. The National Institute for the Sciences of the Universe (**INSU: Institut national des sciences de l'Univers**) has the remit of defining, developing, and steering research efforts at the national, and international scale, in the fields of astronomy, Earth and ocean science, and space science, carried out within CNRS, and in public-sector educational establishments.

CERN: the European Organization for Nuclear Research, the acronym standing for the name of the initial provisional institution (Conseil européen pour la recherche nucléaire: European Council for Nuclear Research); based at the Franco-Swiss border, this is the largest particle physics center, the world over.

China Aerospace Science and Technology Corporation (CASTC): the Chinese national space agency, set up in 1968 as the China Aerospace Corporation (CASC); it operates under the China National Space Administration (CNSA), and the Commission of Science, Technology and Industry for National Defense (COSTIND), and is involved in the Center for Space Science and Applied Research (CSSAR) of the Chinese Academy of Sciences.

European Southern Observatory (ESO): set up, in 1962, to establish an astronomical observatory in the Southern Hemisphere, this has become the chief protagonist in European observational astronomy, with a fleet of 20 instruments or so [allowing observations to be made in terms of imaging, photometry, spectroscopy,

interferometry, at virtually all wavelengths, ranging from the near ultraviolet to the thermal infrared], and three observation sites, in Chile.

European Space Agency (ESA): the organization charged with the development of European space capabilities, and coordinating funding resources from its member states, to undertake programs, and activities beyond the abilities of any one of these states acting individually, with regard to knowledge of the Earth, of the Solar System, and of the Universe; and to develop technologies and satellite services, and promote European industry.

Horizon Project: springing from the coming together of 5 teams, from various French institutes, the Horizon collaborative project aims to use a massively parallel architecture, for the purposes of investigating galaxy formation, in a cosmological context, on the basis of numerical simulations. The aim is to make use of extant centralized computing resources in France (CEA's **CCRT**; Institut du développement et des ressources en informatique scientifique [IDRIS] at **CNRS**; Centre informatique national de l'enseignement supérieur [CINES]), under the aegis of France's National Programs on Cosmology and Galaxies.

Institut d'astrophysique spatiale (IAS): the Institute of Space Astrophysics, a joint research unit run by **CNRS** and Paris-XI (Paris-Sud) University, Orsay, focusing on investigation of the Sun, planets in the Solar System and exoplanets, extraterrestrial and interstellar matter, galaxies and cosmology, space instrumentation, experimental astrochemistry, with reference to extraterrestrial and interstellar solid matter, and the detection of dark matter, using massive bolometers.

Institut für Astronomie und Astrophysik-Tübingen (IAAT): the Tübingen Institute for Astronomy and Astrophysics (Germany): see **Max-Planck-Institut**.

Institut national de physique nucléaire et de physique des particules (IN2P3): the National Institute of Nuclear Physics and Particle Physics, coming under **CNRS**, charged with promoting, and bringing together research activities in the fields of nuclear physics, and high-energy physics; it steers programs concerned with these areas, on behalf of CNRS and French universities, in partnership with CEA; these research activities have the purpose of exploring elementary-particle physics, the fundamental interactions arising between such particles, along with their assembly to form atomic nuclei, and investigating these nuclei.

Instituto de Astrofísica de Canarias (IAC): the Canary Islands Institute of Astrophysics, set up in 1975 at La Laguna university, Tenerife, Canary Islands (Spain).

Japan Aerospace Exploration Agency (JAXA): set up in 2003, as a result of the merger of the Institute of Space and Aeronautical Science (ISAS), dedicated to space and planetary research; the National Aerospace laboratory (NAL), carrying out research and development activities with regard to next-generation aircraft; and the National Space Development Agency (NASDA), charged with development of large-capacity launch vehicles, e.g. the H-2A launcher, and of a number of satellites, together with components of the International Space Station.

Jet Propulsion Laboratory (JPL): a laboratory jointly run by **NASA**, and the California Institute of Technology (CalTech), charged with construction work for, and oversight of, NASA's unmanned space missions.

Laboratoire Astroparticule et cosmologie (APC): the Astroparticle and Cosmology Laboratory, bringing together **CNRS**, CEA, Paris-VII University, the **Observatoire de Paris**, and the Kavli Institute for Particle Astrophysics and Cosmology at Stanford University (USA); it has made possible the setting up of a



transatlantic axis, to bolster collaborations, and project coordination in the field of astroparticles (dark energy and dark matter, high-energy gamma-rays and gamma-ray bursts, gravitational waves, theoretical physics, data processing, numerical simulation).

Laboratoire d'astrophysique de Marseille (LAM): the Marseille Astrophysics Laboratory, a joint research unit, run by **CNRS** and Aix-Marseille-I University, combining fundamental research in astrophysics, and technological research in the area of instrumentation; it conducts major programs in the fields of cosmology, of the physics of galaxies, and galaxy evolution, of the interstellar medium, star and planetary formation, the Solar System, and astronomical optics.

Laboratoire d'études spatiales et d'instrumentation en astrophysique (LESIA): the Space Research and Astrophysical Instrumentation Laboratory, one of the five scientific departments at the **Observatoire de Paris-Meudon**, and a **CNRS** laboratory associated to Paris-VI and Paris-VII Universities.

Laboratoire de photonique et de nanostructures: the Photonics and Nanostructures Laboratory, a **CNRS** laboratory set up for the purpose of ensuring the coordinated advancement of fundamental, and applied research, by drawing on, and developing its own areas of technological expertise.

Leiden Observatory: founded in 1633 by Leiden University (Netherlands), to house the quadrant built by Snellius, this is one of the oldest observatories in continued operation. Its astronomy department, the largest in the Netherlands, has gained worldwide recognition for its research work in various areas in astronomy.

Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V. (MPG): the Max Planck Society for the Advancement of Science is a German independent, nonprofit public-sector organization, which promotes, and supports the research activities carried out by its own institutes. Set up on 26 February 1948, its activities complement those undertaken by German academia (bringing greater resources, and a truly interdisciplinary character), or work in collaboration with it. MPG thus plays a role similar to that of **CNRS** in France, in supporting fundamental research at an international level. The Society currently has 80 institutes, with a combined staff of 13,000.

Max-Planck-Institut für Astrophysik (MPA): one of the 80 research institutes in **MPG**. Set up in 1958, the **Max-Planck-Institut für Physik und Astrophysik** was split, in 1991, into several institutes: MPA, **MPE**, and the Max-Planck-Institut für Physik (MPP). Based in Garching (Germany) – next door to **ESO** headquarters – MPA addresses many issues in theoretical astrophysics, from stellar evolution to cosmology. It has a staff of 120, including 46 permanent research scientists. Since 1996, MPA is a member of the European Association for Research in Astronomy (EARA), the membership of which includes **IAC**, and the Paris Astrophysics Institute (IAP).

Max-Planck-Institut für extraterrestrische Physik (MPE): one of the 80 research institutes in **MPG**. Set up in 1963, as part of the then **Max-Planck-Institut für Physik und Astrophysik**, MPE became an independent institute in 1991. Based in Garching (Germany), MPE includes, among its main research topics, astronomical observations in those spectral regions that are only accessible from space (far infrared, X-rays, gamma rays), and the physics of cosmic plasmas.

Max-Planck-Institut für Radioastronomie (MPIfR): one of the 80 research institutes in **MPG**. Set up in 1966, from the Institute for Radioastronomy at Bonn University, which went back to the 1950s, MPIfR focuses on searching for astronomical objects in the radio, and infrared regions. The Institute operates a 100-meter diameter radiotelescope, at Effelsberg, commissioned in 1972. MPIfR runs, with **ESO** and **OSO**, the APEX radiotelescope, sited in Chile.

National Aeronautics and Space Administration (NASA): set up on 29 July 1958, on the basis of the erstwhile National Advisory

Committee for Aeronautics (NACA), NASA acts as the US space agency, running most civilian space activities in the United States, along with collaborations with agencies in other countries. NASA covers 18 research centers, including the Ames Research Center, at Moffett Field, Mountain View (California), or the **Jet Propulsion Laboratory**, Pasadena (California).

NVIDIA Corporation: a fabless US company (i.e. with a design, but no manufacturing capability), one of the leading suppliers of graphics processing units and cards, chipsets, game consoles...

Observatoire de Paris: set up in 1667, the Paris Observatory is now a "major establishment" under French law, coming under the French Ministry for Higher Education and Research. Its official status is that of a university, and it includes 7 laboratories, operating as joint research units, with **CNRS** and major scientific universities in the Paris area. This national astronomical research center is established at three sites: **Paris**, **Meudon**, and **Nançay** (radiotelescope).

Observatoire des sciences de l'Univers de Grenoble (OSUG): the Grenoble Observatory for the Sciences of the Universe, bringing together 6 laboratories (including the **Astrophysics Laboratory**), and 3 research teams, from Joseph-Fourier University (Grenoble, France), in partnership with **CNRS/INSU**. OSUG focuses on three main topics: the Universe, the dynamics of the Earth, and major natural cycles.

Office national d'études et de recherches aérospatiales (ONERA): the National Aerospace Design and Research Bureau, the prime French player in the field of aeronautical, space, and defense R&T; its remit being to steer and lead aerospace research; support commercial applications for such research, for both French and European industry; set up and operate the associated experimental facilities; provide industry with high-level expert analyses, and other services; carry out in-depth examinations for government services; and train researchers, and engineers.

Onsala Space Observatory (OSO): a Swedish radioastronomy observatory, founded in 1949, coming under the Chalmers University of Technology, this being a private foundation; OSO is partly funded by the Swedish Ministry of Research. This facility operates two radiotelescopes (20-meter, and 25-meter diameter), and is a participant in many international projects, in particular APEX, ALMA, Herschel...

Royal Observatory, Edinburgh (ROE): home to one of the centers of astronomical research in the United Kingdom, which has contributed to the construction of a number of instruments, used in ground-based observatories, or carried on satellites. ROE houses the Crawford Library, one of the most comprehensive astronomical libraries the world over.

SAGEM: a French high-technology manufacturer, a world leader for solutions, and services in optronics, avionics, electronics, and critical software packages, for both civilian and defense markets.

Thales (formerly Thomson-CSF): a French electronics company, specializing in aerospace, defense, information technology, currently a world leader with regard to critical information systems, in the aviation and space, defense, and security markets.

United Nations Educational, Scientific and Cultural Organization (UNESCO): set up in 1945, to promote peace in the minds of men, through education, science, culture, and communication.