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The European Space Agency

For several decades the member states of ESA, the European Space Agency, have been pooling their resources to create a dynamic programme of space exploration and technology.

With vision and imagination, Europe's most brilliant scientists and skilled engineers have brought space into our lives through diverse and dynamic means, in the fields of:

- Exploration of the Solar System and deep space
- Earth observation and meteorology
- Satellite communications and satellite navigation systems
- Human space flight and space observatories
- Launchers

Member states:
Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom. Canada takes part in some projects under a cooperation agreement. The Czech Republic, Hungary, Poland and Romania are participating in a Plan for European Cooperating States.

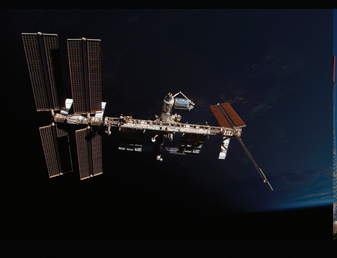
Exploring the Universe

Immediately after the Big Bang, almost 15 billion years ago, the universe was initially extremely hot. Matter as we understand it today did not yet exist. The development of protons and electrons into stars, galaxies and living creatures still remains a largely unsolved mystery.

Space telescopes, such as Hubble and ESA's XMM-Newton and Integral, are studying the universe beyond the visible light range, observing black holes, exploded stars and celestial objects that exist under extreme gravity, density and temperature conditions.

The soon to be launched Herschel and Plank space telescopes will delve yet deeper into the universe in order to study its origins and to solve the mystery of how stars and galaxies form. Herschel will be the largest space telescope of its kind.

Herschel's mirror will collect long-wavelength infrared radiation from some of the coolest and most distant objects in the Universe. Plank is Europe's first mission to study the relic radiation from the Big Bang. Astronomers use small fluctuations in the temperature of this radiation to understand how the Universe originated and how galaxies form.







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ESO's Very Large Telescope

The Very Large Telescope (VLT) array is the flagship facility for European astronomy at the beginning of the third millennium. Sitting atop the Paranal Mountain, its design, instrument complement and operating principles set the standard for ground-based optical and infrared astronomy.

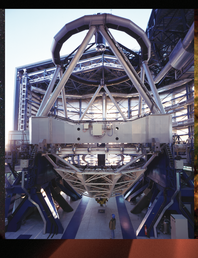
It is the world's most advanced optical instrument, consisting of four Unit Telescopes (UTs) with main mirrors of 8.2-m diameter and four movable 1.8-m Auxiliary Telescopes (ATs).

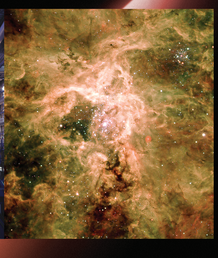
The telescopes can work together, in groups of two or three, to form a giant 'interferometer', allowing astronomers to see details corresponding to those from a much larger telescope. The 8.2-m Unit Telescopes can also be used individually. With one such telescope, one can see objects that are four billion times fainter than what can be seen with the unaided eye.

Adaptive Optics technology allows the instruments on the VLT to overcome the blurring effects of the atmosphere, producing images almost as sharp as if taken from space. In theory, Adaptive Optics allows the VLT to read a newspaper headline at a distance of more than 10 kilometres.

The first of the Unit Telescopes, 'Antu', had 'First Light' in May 1998 and went into routine scientific operations on 1 April 1999. Today, all four Unit Telescopes and all four Auxiliary Telescopes are operational. Already, the VLT has made an unquestionable impact on observational astronomy.







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Two examples of research at the ESRF

Investigating materials made in space

Intermetallic alloys are candidates for advanced high-temperature materials and catalysts. Applications range from replacing costly platinum in hydrogen fuel cells to improving jet engine turbine blades for better fuel economy.

Gravity affects the properties of alloys when they solidify. Samples produced on parabolic flights, in sounding rockets or at the International Space Station reveal their crystalline and microscopic structure in the X-rays of the ESRF.

Revealing invisible fossil insects

Fossils are very well preserved by amber. However, when amber is opaque, the fossils remain invisible in absorption-based X-ray imaging. Using phase-contrast techniques, some 600 pieces of amber screened at the ESRF revealed 356 different animal inclusions, most of them very small. X-ray imaging resolved them in fine detail, making possible accurate 3-D reproduction and a better understanding of evolution.



The European Synchrotron Radiation Facility (ESRF) is an international institute located in Grenoble (France) funded by 18 countries. It operates one of the world's most powerful synchrotron light sources and hosts more than 6000 scientific user visits to 43 beamlines every year.

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CERN	*The world's largest particle physics laboratory, where the World Wide Web was born*	*www.cern.ch*
ESO	*The world's most advanced optical and near-infrared telescopes*	*www.eso.org*
EFDA	*Operates JET, the world's largest nuclear fusion research facility*	*www.efda.org*
esa	*Europe's gateway to space*	*www.esa.int*
ill	*The world's leading facility in neutron science and technology*	*www.ill.eu*
EMBL	*Europe's flagship laboratory for basic research in molecular biology*	*www.embl.org*
ESRF	*A light for science*	*www.esrf.eu*