

INSU - National Institute for Earth Sciences and Astronomy

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LPC2E - UMR 7328

Laboratory of Physics and Chemistry of the Environment and Space

The laboratory of Physics and Chemistry of the Environment and Space **LPC2E** is a common research unit of Centre National de la Recherche Scientifique (CNRS) and the University of Orléans. It belongs to Institut des Sciences de l'Univers (INSU) of CNRS, and is a founding member of the Observatoire des Sciences de l'Univers en Région Centre (OSUC).

Research activities at LPC2E encompass three distinct domains :

- space plasma physics
- physics and chemistry of the terrestrial atmosphere and of planetary environments
- radioastronomy

These research activities rely in particular on the development and data analysis of scientific instruments onboard spacecraft and space probes, under stratospheric balloons, aboard aircraft for atmospheric research or simulating micro-gravity, or on ground for laboratory and field studies. In this context, LPC2E is one of the main french laboratoires in space science working in strong partnership with Centre National d'Etudes Spatiales (CNES) and has now been placed under CNES supervision since January 1st 2018. LPC2E is involved in a laboratory quality control aiming at ISO 9001 certification in the future.

Be it for sensors, electronics, or onboard data processing, the instrumentation developed at LPC2E must be suitable for the harsh environment in space or in the upper atmosphere, and meet quality requirements set by national and international agencies (CNES, ESA, NASA...)



LPC2E site, on the ORLEANS campus

Staff

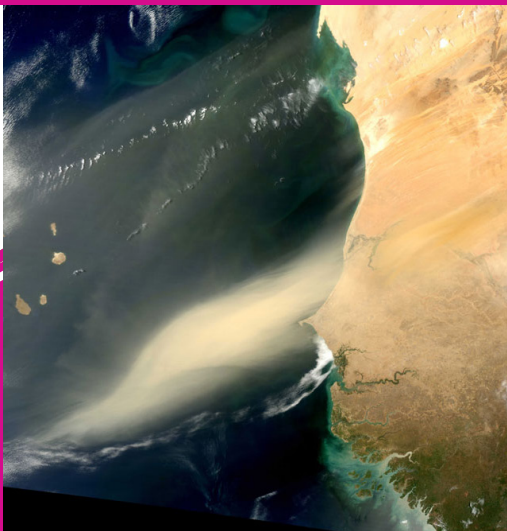
- 30 tenured researchers and research faculty
- 18 doctoral and post-doctoral researchers
- 44 CNRS engineers, technicians and administrative staff



Keywords

Physical chemistry of the atmosphere, stratosphere, troposphere, polar and tropical regions, ozone, exchanges at the geosphere-atmosphere interface, free radicals, greenhouse gases, water vapor, aerosols, volcanoes, climate, stratospheric dynamics, atmospheric electricity, modeling, infrared laser and ultraviolet-visible spectrometry. Physics of space plasma, solar-terrestrial relations, external geophysics, space weather, solar wind, magnetosphere, ionosphere, mesosphere, waves and turbulence in plasmas, transient energetic phenomena in the upper atmosphere, radio waves, electromagnetic environment of the Earth, planetary and cometary environments, astronomy, pulsars, exoplanets, gravitational waves, electric and magnetic sensors, mass spectrometry, space instrumentation, space technology, signal processing, modeling microelectronics.

Dust cloud



Research Training



LPC2E is part of different MD programs, namely:

- Master de Physique Fondamentale et Applications (PhyFA), parcours Space Sciences and Applications (SSA),
- Master Risques et Environnement (RE), parcours Chimie Pollutions, Risques, Environnements (CPRE)
- Master Instrumentation, Métrologie, Management de la Performance des Systèmes (IM2PS), specialty Instrumentation, Contrôle, Management des Systèmes (ICMS)

COLLABORATIONS: LPC2E has close collaborations with more than 20 laboratories in France and numerous laboratories and institutes abroad in the frame of european programs and international cooperations.

CNRS Regional Office Centre Limousin Poitou-Charentes

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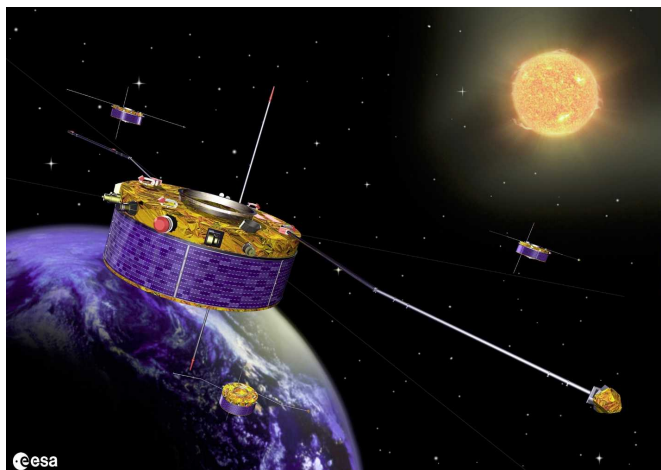


Research Focus

Research in physical chemistry of the Earth atmosphere is motivated by the problems of global climate change, such as the evolution of ozone and greenhouse gas emissions in the stratosphere. Their aim is to study the chemical composition and dynamics of the upper troposphere and stratosphere at all latitudes, as well as to study the exchange at the interface geosphere-atmosphere interface, volcanic degassing and chemical reactivity. They couple measurements of chemical species (by remote and *in situ* optical spectrometry) and aerosols, numerical modeling, as well as field and laboratory studies (in partnership with ISTO and ICARE laboratories of CNRS and Université d'Orléans, INRA and BRGM).

Research on planetary environments (atmospheres, surface, cometary dust) is based on *in situ* measurements. The laboratory develops chemical analysis techniques based on mass spectrometry at very high resolution for the study of mineral phases of cometary grains or the environment of planets, satellites and small bodies of the Solar System, with potential applications in exobiology.

Research in the physics of space plasma is oriented towards the study of interactions between particles from the Sun and ionized environments of Earth, planets and comets. Research topics include characterization of the ionized medium (plasma parameters and energetic particles, electrostatic or electromagnetic waves), the study of plasma turbulence, the knowledge of the electromagnetic environment of the Earth, and space weather.



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Space experiments



Experiments carried out under balloons

Experimental facilities

Lab technics:

- electronics and micro-electronics
- technology
- precision engineering
- optics spectroscopy
- mass spectrometry

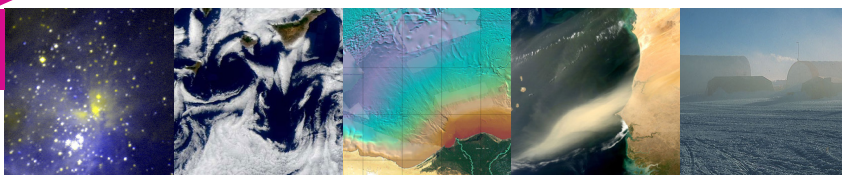
Design office : CAO, DAO, IAO et clean room.

Instruments onboard spacecraft from CNES (e.g., TARANIS), ESA (e.g., ROSETTA, Solar Orbiter), NASA (Parker Solar Probe), or ESA-JAXA (BepiColombo)

New fields of research include transient energetic phenomena in the upper atmosphere, to which are dedicated the TARANIS satellite from CNES (under the scientific responsibility of LPC2E) and balloon campaigns. These phenomena range from the stratosphere up to the ionosphere, thus linking the two previous themes.

Research topics in radioastronomy focus on the study of neutron stars (pulsars) and exoplanets. For this, radio emissions from celestial objects are observed and measured from radiotelescopes, mainly Nançay radioastronomy station. Observation activities are complemented by theoretical work on the sources of gravitational waves.

These experimental programs are based on research and development in instrumentation, metrology, signal processing, electronics and microelectronics.



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