LPC2E

UMR7328

EARTH SCIENCES AND ASTRONOMY

LPC2E

LABORATOIRE DE PHYSIQUE ET CHIMIE DE L'ENVIRONNEMENT ET DE L'ESPACE

Laboratoire de Physique et Chimie de l'Environnement et de l'Espace (LPC2E) is part of Institut National des Sciences de l'Univers (INSU) of CNRS and it is one of the funding laboratories of Observatoire des Sciences de l'Univers region Centre (OSUC).

- physico-chemistry of the Earth's atmosphere and planetary environments
- space plasma physics
- radio astronomy

These research activities are based on the development and the scientific operation of instruments onboard satellites and space probes, under stratospheric balloons, onboard aircraft dedicated to atmospheric research or simulating microgravity, or on the ground for field and laboratory studies. Within this framework, LPC2E is one of the main laboratories working in close partnership with CNES. The laboratory is committed to a QA approach with the ultimate aim of achieving ISO 9001 certification. Be it for sensors, onboard electronics or onboard data processing, the instrumentation developed at LPC2E must be adapted to the extreme conditions of space environment or those prevailing in the high-altitude atmosphere, and it must meet quality requirements of national and international agencies (CNES, ESA, NASA...)

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RESEARCH TOPICS

PHYSICO-CHEMISTRY OF EARTH'S ATMOSPHERE AND PLANETARY ENVIRONMENTS

Research studies in the physico-chemistry of Earth's atmosphere are motivated by the problems of climate change such as the evolution of the ozone layer and the greenhouse effect in the stratosphere. The objective of these studies is to examine the chemical composition and dynamics of the high-altitude troposphere and stratosphere at all latitudes, as well as exchanges at the geosphere-atmosphere interface, volcanic outgassing and chemical reactivity. They couple measurements of chemical species (by both remote and in situ optical spectrometry) and aerosols under stratospheric balloons or from dedicated aircraft, numerical modeling at different scales, as well as ground field campaigns and chemical reactivity studies in the laboratory (in partnership with ISTO and ICARE laboratories, as well as INRAE and BRGM).

The study of planetary environments (atmospheres, surface, cometary dusts) is based on in situ measurements. The laboratory develops techniques for physico-chemical analysis based on very high resolution mass spectrometry (Orbitrap™) for the study of mineral phases of grains of cometary or planetary origins, with potential applications in exobiology.

PHYSICS OF SPACE PLASMAS

Research in space plasma physics focuses on the study of interactions between particles of solar origin and the ionized environments of Earth, planets and comets, which is essential for space weather. These studies are associated with prominent activities in the development of sensors dedicated to electric and magnetic field measurements, and this allows LPC2E to be part of major international space missions (ESA, NASA, JAXA). A new research domain emerges concerning transient luminous events (TLE) and transient gamma-ray flashes (TGF) in the upper atmosphere, to which are dedicated the CNES TARANIS spacecraft (under the scientific responsibility of LPC2E) and balloon campaigns. These phenomena range from the stratosphere to the ionosphere, thus building a link with the two themes above.

RADIO ASTRONOMY

Research topics in radio astronomy include the study of neutron stars (pulsars) and exoplanets. On this purpose, radio emissions from celestial objects are observed and measured from radio telescopes, viz., mainly the radio astronomy station in Nançay with NRT and the new NenuFAR antenna array. These observation activities are supplemented by theoretical studies and work on gravitational wave sources.

These various projects are based on significant Research & Development activities as well as studies in metrology, signal processing and artifical intelligence, electronics and microelectronics.

EXPERIMENTS

Labs :

- electromagnetic sensors
- optical spectroscopy
- mass spectrometry
- electronics and microelectronics
- space technology
- design office, mechanical workshop and 3D printing
- clean room

Instruments under balloons, in aircraft and on the ground (LOAC, SPIRIT, SPECIES, Hygrometer), and instruments on current or forthcoming space missions : CNES (TARANIS), ESA (Rosetta, Solar Orbiter, CLUSTER, JUICE, Comet Interceptor), NASA (Parker Solar Probe), or ESA-JAXA (BepiColombo)

TRAINING

LPC2E is involved in different teaching sectors :

- Master Degree in Fundamental Physics and Applications (PhyFA), Space Sciences and Applications (SSA) cursus
- Master Degree in Risk and Environment (RE), Chemistry Pollution, Risks, Environment (CPRE) cursus
- Master Degree in Instrumentation, Metrology, Management of Systems Performance (IM2PS), specialty in Instrumentation, Control and Management of Systems (ICMS).

COLLABORATIONS

LPC2E collaborates with more than 20 french laboratories and a number of laboratories and institutes abroad within the frame of european programs or international cooperations.

KEY FIGURES

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Researchers (CNRS) and Professors-Assistant Professors

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Engineers, Technicians and Administration staff

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CDD

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PhD Students and Postdoctoral Researchers

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