Collaborations

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LAG: Laboratoire de Dynamique, Interactions et Réactivité - Jussieu, Vitry-Thiais
LPPM: Laboratoire des Interactions Protonnées-Métal – CEA, Cadarache
USA: Laboratoire Inter-Universitaire des Systèmes Atmosphériques - Jussieu, Créteil
LPPM: Laboratoire de Physique Moléculaire - Orsay

Energy range of AILES: 0.4 eV – 0.9 eV
i.e. wavelength between 3 µm and 3 mm

Light source: bending magnet

Experimental techniques:
- Fourier transform infrared spectroscopy
- High resolution for gas phase experiments
- Medium resolution for condensed matter experiments

Topics and applications

Experimental conditions can be adjusted owing to the availability of several sample environments:
- Low temperature cryostat, high pressure diamond anvil cell, magnetic field cell.

- High resolution gas phase spectroscopy
  - Determination of characteristic spectra of molecules of atmospheric and astrophysical interest in the terahertz range (far infrared, near microwaves).
  - Detection of carbonaceous molecules in interstellar space (Herschel mission).

Applications in astrophysics and atmospheric physical chemistry

- Dynamics of molecules in solution
  - Studies of molecules in micellar and lamellar confinement structures: excitons for drugs, supports for nanomaterials.
  - Study of reaction centres of proteins.

Applications in pharmacology, nanotechnology

- Physical chemistry of interfaces
  - Study of materials in thin film for microelectronics and other applications.

Applications in pharmacology and biophysics

- Optical properties of solids
  - Study of non-conventional crystalline solids such as high temperature superconductors (HTS), organic superconductors and molecular magnets.
  - In situ study of co-associates hybrid materials (organic and inorganic)

Application: nanotechnology

AILES beamlines take advantage of synchrotron radiation specificities: high brightness combined to a spectral range extending from medium infrared to sub-millimetre.

Experiments will be carried out with a series of molecules that may present in the interstellar medium and in planets and Earth atmospheres. Recorded spectra will be compiled in data banks and compared to those obtained in space missions, such as the Herschel mission, dedicated to studying the Universe in the sub-millimetre and far infrared wavelength range.

AILES, Advanced Infrared Line Exploited for Spectroscopy
Infrared and THz spectroscopy for dynamic
and optical studies of materials or isolated molecules

Zoom: A new infrared photon source
suitable for 3rd generation synchrotrons

The vacuum chambers of SOLEIL storage ring have been modified to allow extracting the “classic” synchrotron radiation together with that generated by electrons passing in zones of rapidly changing magnetic field. This zone is located on the edge of the bending magnet, hence its name: edge emission.

Isolated molecules can be studied by numerous methods. Among them, rovibration infrared spectroscopy presents the advantage of providing a wealth of structural information and of being broadly applicable. It is usually carried out by photometric detection, although existing setups suffer either from poor sensitivity in the far infrared (FTIR) or from limited spectral coverage (IR lasers).

Zoom: Rovibration spectroscopy
of molecules or isolated clusters