Collaborations

Michel Vervloet: guest scientist
Ecole Centrale - Lyon
ICMMO: Institut des Matériaux et des Molécules d'Orsay
Institut Charles Coulomb - Montpellier
Institut de Physique - Rennes
LADIR: Laboratoire de Dynamique, Interactions et Réactivité - Jussieu, Vitry-Thiais
LIPM: Laboratoire des Interactions Protéines-Métal – CEA, Cadarache
LISA: Laboratoire Inter-Universitaire des Systèmes Atmosphériques - Jussieu, Créteil
LPPM: Laboratoire de Photophysique Moléculaire - Orsay


Pascale Roy
Scientist in charge


Didier Balcon
Associate research engineer – LPPM


Joanna Barros
PhD student


Jean-Blaise Brubach
Scientist

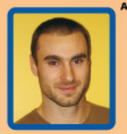

Fridolin Kwabia-Tchana
Associate scientist
LISA


Gaëlle Creff
Post-doc


Laurent Manceron
Associated scientist
LADIR


Marie-Aline Martin
PhD student


Wei-Wei Peng
PhD student

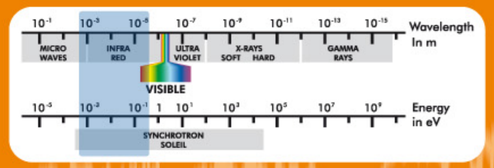

Olivier Pirali
Associated scientist
LPPM


Mathieu Rouzière
Assistant engineer


Fabrice Willaert
Post-doc – ANR FTID

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

Energy range of AILES: 0,4 meV – 0,4 eV
i.e. wavelength between 3 μm and 3 mm

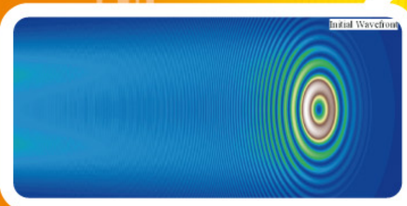


Light source: bending magnet

Experimental techniques:

Fourier transform infrared spectroscopy:
- high resolution for gas phase experiments
- medium resolution for condensed matter experiments

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.
It is characterised by a ring distribution (on the right of the diagram). This source is presently used on several 3rd generation synchrotrons to produce an intense infrared beam.

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 coil.

→ 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).

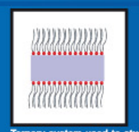
Applications in astrophysics and atmospheric physical chemistry


Herschel satellite. ESA (European Space Agency) mission to be launched in 2008.

→ Dynamics of molecules in solution

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

Applications in pharmacology, nanotechnology

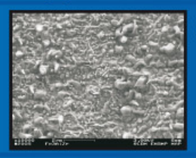

Ternary system used to study water confinement (in blue in the diagram): lamellas


Azurine molecule and its active centre

→ Physical chemistry of interfaces

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

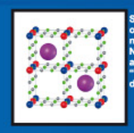
Applications in pharmacology and biophysics


Interface of alumina on aluminium (scanning electron microscopy image).

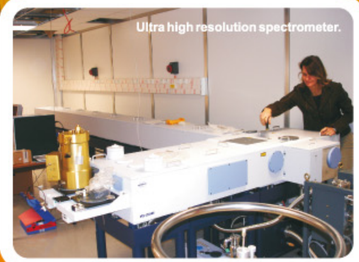
→ Optical properties of solids

- Study of non conventional crystalline solids such as high temperature superconductors (HTcS), organic superconductors and molecular magnets.
- In situ study of auto-associated hybrid materials (organic and inorganic)

Application: nanotechnology


Structural diagram of a molecular magnet: NaFeII[CoIII(CN)6], analogous to the "Prussian blue" dye.

Zoom: Rovibration spectroscopy of molecules or isolated clusters


Ultra high resolution spectrometer.

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).

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.

SOLEIL SYNCHROTRON