MASS SPECTROMETRY COUPLED ACTION SPECTROSCOPY IN THE MID-IR RANGE FOR STRUCTURAL CHARACTERIZATION OF VIRUS-RELATED BIOMOLECULES.

LABORATORY : Institut Lumière Matière

LEVEL : M2
TEAM(S) : SPECTROBIO

CONTACT(S) : ANTOINE Rodolphe

CONTACT(S) DETAILS: rodolphe.antoine[at]univ-lyon1.fr / Tel. 0472431085

KEYWORD(S) :

SCIENTIFIC CONTEXT :

Viruses appear to constitute the most abundant and robust biological entities on earth. All viruses contain a nucleic acid genome and a protein capsid that covers the genome. The capsid is almost always made up of repeating structural subunits that are arranged in one of two symmetrical structures, a helix or an icosahedron. The final, mature capsid is a relatively robust protein complex able to protect the viral genome from physicochemical aggressions; however, it is also a metastable, dynamic structure poised to undergo controlled conformational transitions required to perform its biological activity. Studies aiming at evaluating the fragmentation of viruses are very scarce.

New electrostatic traps (linear ion traps) have recently been implemented to achieve fragmentation experiments on selected ions. The coupling with a CO2 laser allows to perform infrared multiphoton dissociation of and to determine the unimolecular dissociation energy of activation of macro-polymers and whole DNAs. The trapped ions are then irradiated with CO2 laser and fragmented by vibrational heating following a multiphoton IR activation.

MISSIONS :

The project will be conducted following the key objectives: Perform native mass spectrometry on virus-related biomolecules (mainly surface proteins) and demonstrate that action spectroscopy in the mid-IR range is a viable experimental method for the detection and identification of viral particles.

The implementation of vibration selective photofragmentation using tunable mid-IR laser (5 to 9 µm range) will permit to access their fine structures. Indeed, in this mid-IR range, vibrations are specific to the different components of viral particles and can be used as fingerprints. In particular one of the ultimate goal is to establish a link between the photo-fragmentation observed in viruses and their structure and establish laws and mechanisms for energy dissipation in these objects.

The M2 student will work on the upgrading of the experimental set-up as well as on the development of the experimental setup aiming at characterizing viruses and their photo-fragmentation. A big part of the master internship work will be to perform and interpret photo-fragmentation induced by infrared laser irradiation on proteins.

OUTLOOKS :

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