Laboratory experiments on Complex Organic Molecules (COMs) of interest for Astrobiology

ASSOCIATED INAF PROJECT (SCHEDE INAF): LASERS - Laboratory AStrophysics Experiments Relevant to Space

BUDGET: 18 Keuro

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Scientific Motivation: One of the main challenges in the field of Astrobiology is to understand the processes underlying the early evolution of life. Addressing this issue requires the study of the class of molecules known as Complex Organic Molecules (COMs) and the comprehension of the principles governing their evolution into prebiotic systems. Infrared spectroscopy and mass spectrometry are the most commonly used techniques for the study of simple solid-state COMs under conditions simulating the space environment. However these techniques have reached their intrinsic limit when analyzing larger COMs: is not always possible to distinguish the spectral contribution coming from larger species and their proper identification. **The main goal of this Project is to perform research visit to laboratories which employ state of the art techniques able to overcome these limitations, such as Time Of Flight Mass Spectrometry (TOF-MS) and Orbitrap Mass Spectrometry (Orbitrap-MS), to fill the knowledge and expertise gap regarding these high-resolution techniques currently not available in INAF laboratories.**

Milestones and Time Schedule Progress

During the 2 years of the Project, we planned to organize and perform dedicated experiments in the following laboratories:
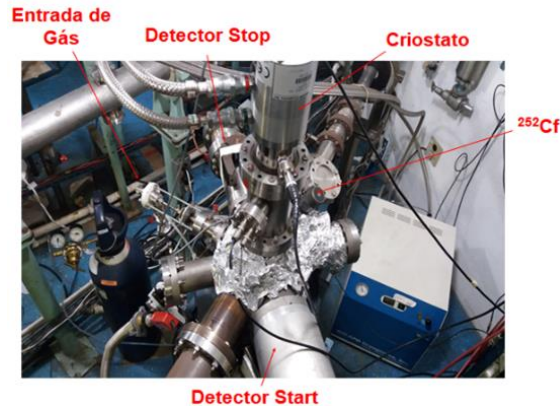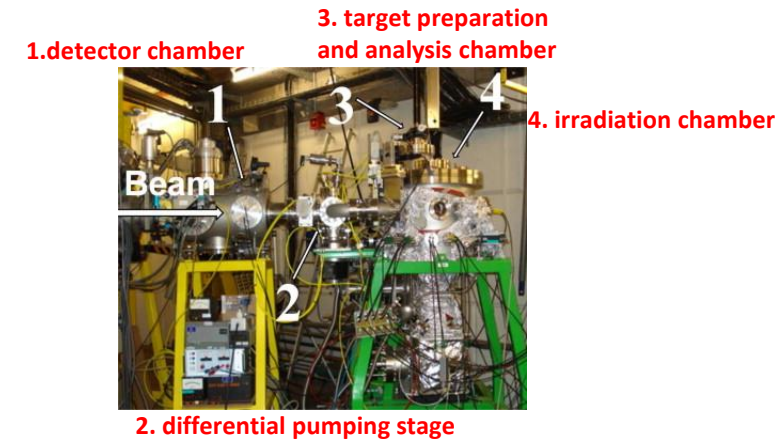
1) VDG Laboratories - Pontifical Catholic University of Rio de Janeiro (Brazil): TOF-MS	2) Max Planck Institute for Astronomy in Heidelberg (Germany): Orbitrap-MS	3) GANIL Laboratories in Caen (France): TOF-MS

1st year (2023)

2nd year (2024)

✓ exps planned; material bought; research visit occurred in Oct 2023	currently planning of exps and research visit, to occur in 2024	backup plan, eventually to occur late in 2024

Preliminary Results and Expenses

1) VDG Laboratories - Pontifical Catholic University of Rio de Janeiro (Brazil):
TOF-MS

2) Max Planck Institute for Astronomy in Heidelberg (Germany):
Orbitrap-MS

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TOF-MS

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Expenses:

about 65% of the budget has been already used to support the research visit to the VDG labs, participation to two conferences and to buy laboratory material for the planned scientific activities.

Preliminary Results:

during the visit to the VDG labs, we were able to fix the TOF-MS there available and to perform experiments with it. We are currently analyzing the data there acquired and a peer-reviewed publication is foreseen in 2024. The experience gained at the VDG labs is having a huge impact to fill the knowledge gap regarding this high-resolution technique.