UNIVERSITY OF LOUISVILLE

COLLEGE OF ARTS & SCIENCES

Department of Chemistry

Brown and Williamson Series
January 12, 2024
@4:00 pm
CBLL16

Dr. Salma Bejaoui, Ph.D.

NASA Ames Research Center and Bay Area Environmental Research Institute

CAVITY RING DOWN SPECTROSCOPY OF INTERSTELLAR PAHs AND PAH-RELATED ANALOGS-ASTRONOMICAL APPLICATIONS

ABSTRACT:

Polycyclic Aromatic Hydrocarbons (PAHs) are ubiquitous in space and most astronomical spectra, from the interstellar medium (ISM) to distant galaxies, including regions of massive star formation, the general ISM, and star forming spiral galaxies out to red-shifts of z>4, are dominated by their ubiquitous infrared emission features. Whether the PAH bands are intimately associated with the object, or foreground/background confounding features, they will have to be understood, separated from other features in the spectra, and analyzed for the information they contain on the physical and chemical properties of their surrounding environments.

High-resolution laboratory spectra of PAHs measured in an astrophysically-relevant environment are critical to answer these questions. The most challenging task is to reproduce, as closely as technically possible, the physical and chemical conditions that are present in space (i.e., cold gas phase molecules and ions, isolated in a collision-free environment). Comparable conditions can be achieved using the cosmic simulation chamber (COSmIC) developed at NASA Ames. COSmIC allows to measure gas phase spectra of neutral and ionized interstellar PAH analogs by associating a free supersonic jet with a soft ionizing discharge that generates a cold plasma expansion (≈100 K). Using the Cavity Ring Down Spectroscopy (CRDS) technique, rovibronic absorption spectra of PAHs and PAH derivatives seeded in Ar supersonic jet expansions are measured in the NUV-Vis-NIR region. The resulting spectra provide a critical tool to identify and characterize specific molecules and ions in astrophysical environments. We intend to expand the capabilities of our current CRDS system to the NIR and MIR up to 3.5 μm in order to provide accurate high-resolution laboratory spectra that will help validate the extensive NASA Ames' PAH database and will greatly benefit the interpretation of future James Webb Space Telescope NIRSpec observational data.

BIO:

Dr. Bejaoui received her Ph.D. degree in physical chemistry at the University of Lille 1 (Physicochimie de processus de combustion et de l'atmosphère) in France, where she developed laser-based techniques to study the formation processes of polycyclic aromatic hydrocarbon (PAHs) and soot in flame conditions. She followed her PhD with two years of post-doc research at the University of Valenciennes and the Ecole Centrale de Paris (both in France). Dr.Bejaoui was awarded the NASA Postdoctoral program fellowship in 2015 to study the spectroscopy of jet-cooled PAHs with absorption and emission spectroscopy in the ultraviolet-visible region. She is a member of the COSmIC group (Cosmic Simulation Chamber, COSmIC Facility - NASA), a versatile facility that allows the laboratory simulation of planetary and interstellar medium environments.