RAMAN SPECTRAL ANALYSIS OF NITROGENATED AND NON-NITROGENATED POLYCYCLIC AROMATIC HYDROCARBONS FOR THEIR IDENTIFICATION ON TERRESTRIAL PLANETS

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Polycyclic Aromatic Hydrocarbons (PAHs) are a class of organic molecules having more than one fused benzene ring in a honeycomb fashion. These molecules are omnipresent in various astronomical objects [1] and terrestrial planets [2]. Their presence in the interstellar medium (ISM) was first speculated through their emission bands observed at 3.3, 6.2, 7.7, 8.6 and 11.2 μm [1]. From the ISM, PAHs are transported to the planetary surfaces by micrometeorites and interplanetary dust particles [2]. The SHERLOC (Scanning Habitable Environments with Raman and Luminescence for Organics and Chemicals) instrument mounted on NASA's Perseverance rover's robotic arm,found the signatures of aromatic molecules in the Mars' Jezero crater [3]. Similarly,the NASA Raman Spectroscopic database (RAMdB)[4] has been extremely useful for the growing use of Raman spectroscopy in the planetary science community.

PANHs (polycyclic aromatic nitrogen heterocycles) represent a class of PAH molecules where a nitrogen atom replaces a carbon atom. PANH molecules have been detected in meteorite extracts and are of interest to the astrobiology community.[5] Similarly, PANHs have been suggested to explain components of the 6.2 μm ISM feature. [6]

In this work we have recorded the Raman spectra of anthracene and acridine series of PAHs, at multiple excitation wavelengths, in the context of preparation for inclusion in the RAMdb database. Quantum chemical calculations were utilized to simulate the Raman spectra of the studied molecules. Highlights of these results will be discussed in the presentation.

[1] Allamandola et al. ApJ 1989 [2] Kopacz et al., Icarus 2023 [3] Sharma et al., Nature 2023 [4] Mattioda et al., Icarus 2024 [5] Bernstein et al. ApJ. 2005 [6] Ricca et al., ApJ. 2021