

HIGH-RESOLUTION IR ABSORPTION SPECTROSCOPY OF POLYCYCLIC AROMATIC HYDROCARBONS: SHINING LIGHT ON THE INTERSTELLAR 3 MICRON EMISSION BANDS

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Various astronomical objects show distinctive series of IR emission bands indicated as unidentified infrared emission bands. These features are nowadays mainly attributed to the IR fluorescence of Polycyclic Aromatic Hydrocarbons (PAHs) even though an unambiguous identification of which PAHs are involved has not been possible yet. We present here a high-resolution IR absorption study of a number of jet-cooled polycyclic aromatic hydrocarbons in the 3.3 μm region obtained by IR-UV ion depletion techniques. The experimental spectra display many more bands than expected, and lead to the conclusion that the appearance of the spectrum is dominated by fourth-order vibrational coupling terms. This has far-reaching consequences since up till now the assignment of infrared emission features observed in different types of space objects in this wavelength region -and the conclusions drawn from these assignments on the evolution of interstellar gas- has relied heavily on harmonic quantum chemical calculations. We also observe that the presence of bay-hydrogen sites in a PAH leads to a shift of the overall spectrum to the high-energy side and to a broadening of the 3 μm band. This observation provides an appealing explanation for previous speculations that the emission of 3 μm band consists of two components. Moreover, it paves for using this structure to derive the composition of different objects.