The Unidentified Infrared Emission Bands: Identified

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The so-called Unidentified Infrared or simply UIR bands, the infrared emission band spectrum associated with a wide variety of interstellar objects, can be modeled *in detail* by laboratory spectra of neutral and positively charged polycyclic aromatic hydrocarbon (PAH) mixtures. Fits are presented for the UIR emission from the protoplanetary nebula IRAS 22272+5435, the diffuse galactic medium, and the Orion HII/photodissociation front - a selection of objects which span the evolutionary range of interstellar material. These data directly address the spectroscopic criticisms previously leveled at the PAH hypothesis and demonstrate that PAH-related molecular species are indeed responsible for this widespread emission. Furthermore, these fits reflect the structure, abundance, and ionization state of the interstellar PAHs and, in turn, provide direct insight into the processes of carbon nucleation, growth and evolution in circumstellar shells and the interstellar medium. To date, no other candidate material which has been proposed to account for the UIR emission can as readily and specifically reproduce these spectral variations. Given the ubiquity of these species, this work demonstrates the tremendous potential of these species as probes of a new and heretofore largely unexplored facet of astrochemistry - potential which should make PAHs the probe of the next millennium much as CO has been for the last quarter century.

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