Observational and Laboratory Comparisons of Interstellar Organic Matter

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Observations of interstellar near-infrared solid-state absorption bands, which arise from organic carriers within interstellar dust grains, are compared with laboratory spectra of analog materials, in order to identify the composition and/or process involved in the production of organics in the interstellar medium. The laboratory organic residues which best fit the interstellar hydrocarbon bands near 3.4 microns are non-unique in terms of either the production method or the initial starting materials used. There are, however, significant differences in the laboratory spectra in the mid-infrared, and the complete 2-10 micron spectral region of spectra from several lab groups is shown here for comparison to the interstellar data. Laboratory processes considered in the production of interstellar organics include the energetic processing of ices both by ultraviolet photolysis and ion bombardment, as well as plasma processed hydrogenated amorphous carbon samples. Understanding the formation and evolution of the organic component of interstellar dust has relevance for the study of pre- solar material which is incorporated into newly forming planetary systems. A remarkable similarity between the spectrum of the diffuse dust and an organic extract from the Murchison meteorite suggests that some of the interstellar organic material may be preserved in primitive Solar System bodies. The 3.4μm absorption feature (in the rest frame) has now been detected in external galaxies as well, indicating the widespread availability of organic material for incorporation into planetary systems throughout the universe.