Laser-based analysis of complex hydrocarbons: Approaches for *in situ* and returned samples

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Understanding the connections between organic compounds observed in the interstellar medium (ISM), those preserved in comets and asteroids, and those found on planets is a central goal of astrobiology. These connections are clearest if our inventory of such organics is as complete as possible. With samples, we additionally wish to analyze their inorganic host phases and isotopic properties, preferably species-by-species and on a fine spatial scale. This kind of analytical power comes naturally for returned samples shared among labs. *In situ* investigations must be highly selective but still characterize compounds over wide mass, abundance, and stability ranges.

Non-volatile macromolecular hydrocarbons comprise a substantial fraction of the organics in carbonaceous meteorites, and probably of many low-albedo small bodies. Such 'kerogen-like' material is a generally insoluble network of mixed aromatic and aliphatic character. Its analysis on planetary missions is important because: (i) It incorporates PAHs which are a vital link between the ISM and the solar system; (ii) Its abundance, heterocomposition, and maturity record the evolution of the host material; and (iii) It can incorporate fragile compounds and preserve them over geologic times.

We are studying refractory, high-mass hydrocarbons in unprepared samples using laser desorption mass spectrometry (LDMS). LDMS detects these compounds up to thousands of Da, point-by-point, without wet chemical techniques. With a carefully tuned time-of-flight mass spectrometer, molecular fragmentation is observed to vary reproducibly with laser irradiance. LDMS data sets are highly complementary to and diagnostic of those from parallel GCMS analyses of the more soluble fraction.