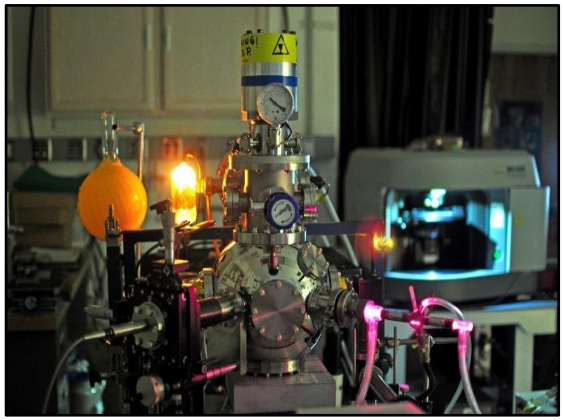

*The NASA Ames **ICEE** (Institute for Carbon Evolution Experiments) Facility is a state-of-the-art facility comprised of a high-vacuum (HV) chamber with in-situ capabilities and an external Raman microscope system.*

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The **ICEE** facility is a *unique* NASA resource, with the ability to process samples via UV and electron radiation while monitoring them with IR, Raman and Mass Spectroscopy.

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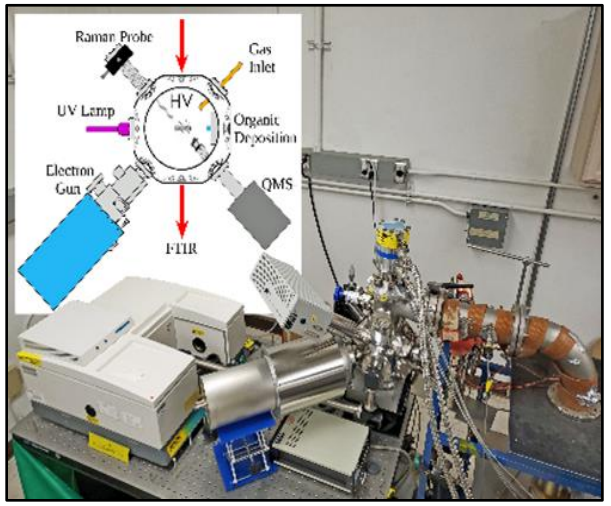


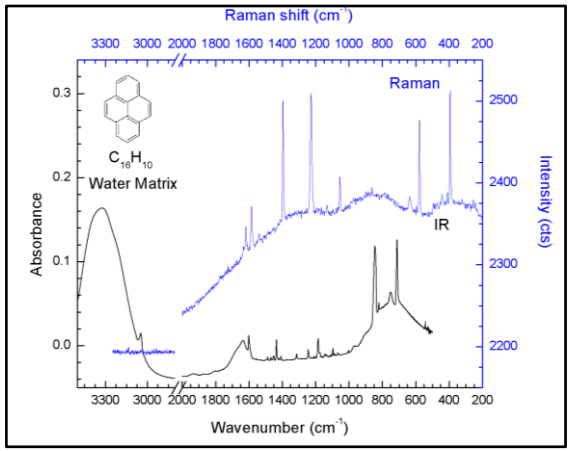
***ICEE** facility setup showing the internal schematics of the HV chamber, the locations of the 100 keV electron gun, UV light source and mass spectrometer attached as well as the in-situ capabilities.*

HV Chamber Capabilities:

The HV chamber (10^{-9} torr) contains an IR transparent window, mounted onto the tip of a rotatable Helium cryo-cooler, capable of temperatures ranging from 15 to 300 K. Gas and solid sample deposition ports are located adjacent to each other in the HV chamber. The sample window can be position to face one or both deposition ports permitting the creation of mixed materials on the sample window.

Three analytical instruments are available for in-situ sample analysis. A mass spectrometer, capable of analyzing the gas phase molecules out to 300 u (atomic mass

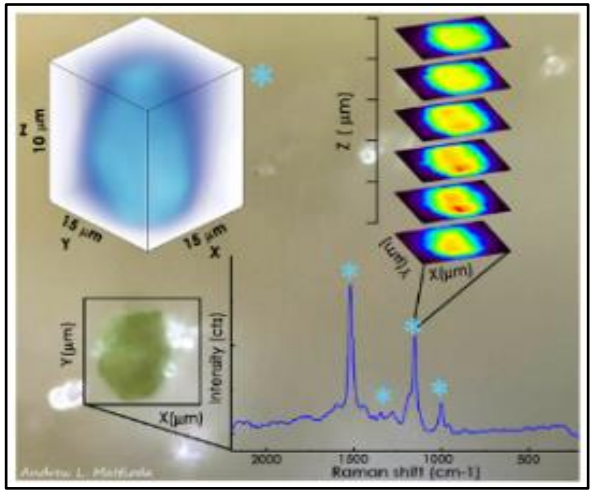
units). An FTIR spectrometer, permitting IR transmission measurements from ~600 nm to over 50 μm, covering the UV, visible and IR spectral ranges. Fiber optic probes (785 and 405 nm excitation wavelengths) permit the acquisition of in-situ Raman spectra.



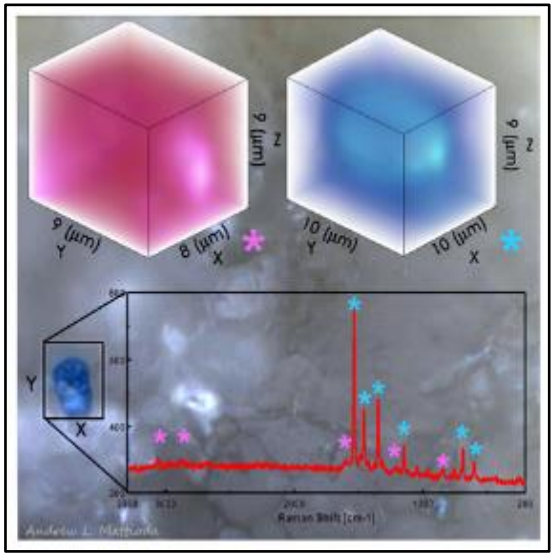
Raman (blue) and IR (black) spectra of a water matrix-isolated PAH molecule (pyrene) sample collected via in-situ Raman and IR.

The HV chamber contains two radiation sources, a high-energy electron gun and a flowing H_2 discharge lamp. The electron gun is capable of producing electrons from 1 – 100 keV, while the H_2 microwave discharge lamp produces Lyman α photons (121.6 nm, 10.2 eV) as well as broad continuum emission. Samples can be position to face one or both radiation sources.

Raman Microscopic capabilities:
The Raman system is equipped with an auto microscope stage and 785, 532 and 405 nm excitation lasers permitting analysis of biological and thin-film sample analysis external to the HV chamber. The Raman microscope is equipped with a 5x, 20x, 50x and 100x objective lenses. The microscope is capable of spectroscopically mapping samples in 3D.



3D mapping of a live bacterial colony located in a salt sample. The major Raman peaks (blue asterisks) can be plotted to reveal the membrane structure or peak intensity distribution.



3D mapping of a decaying bacterial colony located in a salt sample. Major Raman peaks can be classified as narrow (blue asterisks) or broad (red asterisks). Plotting the bands in 3D reveal, the narrow bands conform to the membrane of the colony while the broad bands seem to be leaking out of the membrane.

Raman and IR spectra are archived in online databases ensuring public access of the data to the scientific community and a legacy value to NASA.

PAH IR Spectral Database
Ames Research Center
astrochem.org/PAHdb

Ramdb Raman Spectral Database
Ames Research Center
astrochem.org/Ramdb