

SOFIA Lunch Talk

Date: April 24, 2006

Speaker: Max Bernstein

Title: “IR spectroscopy and real and imaginary indices of ice mixtures of relevance to the outer Solar System”

Abstract:

Much of the outer Solar System is covered by ice; mostly, as on the icy Galilean and Saturnian satellites and KBOs, H₂O ice containing other molecules such as carbon dioxide (CO₂), methane (CH₄), ammonia (NH₃), and other more complex compounds such as nitriles (-CN). Often, much what we know of these icy objects is from Infrared (IR) reflectance spectra. The IR absorptions of molecules in ice depend strongly on the conditions; this is an advantage because it's a probe, but a complication because appropriate lab data is needed to correctly interpret observational data. Outer Solar System IR spectra have been in the near-IR (i.e., below 3 micron, or 5 micron at most) where reflected sunlight is greatest. Very few laboratory spectra of relevant ices have been available in the near-IR, and almost no indices of refraction (n's and k's) for incorporation into scattering models. As a result planetary scientists trying to fit spectra of complex surfaces composed of mixtures have been limited to n's and k's of pure materials, often at the wrong temperature. We shall present near IR spectra of ice mixtures of relevance to icy outer Solar System bodies and show that they still hold surprises, such as the Cheshire cat-like CO₂ (2ν₃) overtone near 2.134 micron (4685 cm⁻¹) that is absent from spectra of pure CO₂ but present in H₂O-CO₂ mixtures, see <http://www.astrochem.org/CO2H2O.html> for spectra. We shall also present near IR spectra for other binary mixtures such as H₂O/CH₄ (see <http://www.astrochem.org/H2OCH4.html>) and H₂O/HCN and H₂O/NH₃ mixtures, and also present n's and k's for ices and mixtures in the near-IR.