



Anomalies in the spectra of planetary ice particles

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Ice particles generated in laboratory by vapour deposition at low temperature and pressure allow the simulation of different icy systems in the atmosphere and surface of Solar System bodies, and in astrophysical particles (1-3). The spectroscopic properties of the laboratory particles can be studied with great detail, and the information deduced from them can be applied to interpret astronomical observations. Using IR spectroscopy and mass spectrometry in Temperature Programmed Desorption (TPD) experiments, we have recently studied ices of mixtures of H₂O, CO₂, CH₃OH and CH₄ under various conditions of temperature and degree of mixing (3-6). Among other results, we have detected the presence of “distorted” CO₂ or CH₄, characterized by frequency shifts or symmetry breakdowns in their vibrational spectra. Such anomalous behaviour can provide a key to understanding observations of remote planetary objects, like Pluto, Triton, Makemake, Quaoar, Haumea, or other Trans-Neptunian Objects. The state of the art of this problem will be revised at the talk.

References:

1. R. Hodyss, P.V. Johson, J.V. Stern, J.D. Goguen, I. and Kanik, “Photochemistry of methane-water ices”, *Icarus* 200, 338 (2009).
2. M.P. Bernstein, D.P. Cruikshank, S.A. and Sanford, “Near-infrared laboratory spectra of solid H₂O/CO₂ and CH₃OH/CO₂ ice mixtures”, *Icarus* 179, 527 (2005).
3. O. Gálvez, B. Maté, V.J. Herrero and R. Escribano, “Trapping and adsorption of CO₂ in amorphous ice: a FTIR study”, *Icarus*, 197, 599 (2008).
4. B. Maté, O. Gálvez, V.J. Herrero and R. Escribano, “Infrared spectra and thermodynamic properties of CO₂/methanol ices”, *Astrophys. J.*, 690, 486 (200).
5. O. Gálvez, B. Maté, V.J. Herrero and R. Escribano, “Spectroscopic effects in CH₄/H₂O ices”, *Astrophys. J.*, 703, 2101 (200).
6. V.J. Herrero, O. Gálvez, B. Maté and R. Escribano, “Interaction of CH₄ and H₂O in ice mixtures”, *Phys.Chem.Chem.Phys.*, 12, 3164 (2010).