The Effect of YSO Environment and Evolutionary Status on Volatile Composition in the Rho Ophiuchi Region

Kari A. Wojtkowski[1], E.L. Gibb[1], S.S. Shenoy[2]
[1]University of Missouri—St. Louis, [2]NASA Ames Research Center
1 University Blvd.
503 Benton Hall
St. Louis, MO 63117
(314) 516-5010

Abstract:

Recent technological advances have sparked an exciting study of the chemistry in star forming regions. By combining Spitzer IRS and ground based observations, a more sensitive diagnostic of the composition of the material surrounding Young Stellar Objects (YSOs) can be performed. An important correlation to consider is the ice abundances with respect to the location of the YSO. For example, Pontoppidan (2006) found that CO_2 and CO abundances were enhanced toward the center of the cold Ophiuchus-F core, and recent results for the CO_2 ice feature at 15.2 μm also imply spatial variations within regions of star formation. However, Whittet et al. (2009) found similar CO_2 profiles for background objects consisting mainly of a polar component (85%) toward three distinct dark clouds, thus providing a benchmark of unprocessed ices to which processed ices can be compared. Here we space-based results for the bending and libration modes of H_2O ice at 6 μm and 13 μm, and the bending mode of CO_2 ice at 15.2 μm of the Rho Ophiuchi star forming region. These data were taken with the Infrared Spectrometer (IRS) on the Spitzer Space Telescope. We measured abundances and used laboratory spectra to constrain the polar/apolar composition and the thermal history of the region. The abundances and profile shapes are compared while considering their location with respect to the Ophiuchus A, B, and F cores, and their evolutionary state. In the future, ground based data from SpeX at the Infrared Telescope Facility will be added which cover the stretching mode of H_2O ice at 3 μm and the 4.67 μm stretching mode of CO ice, allowing for a more comprehensive study.