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Infrared Spectra and Optical Constants of Hydrocarbon Ices Relevant to TNO Surfaces

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Abstract

Hydrocarbon-containing ices have been both assumed and observed as components of icy TNO surfaces [1,2], yet significant gaps exist in our knowledge of these molecules' IR spectra, optical constants, and vapor pressures under astrophysical conditions. In our laboratory we recently have undertaken low-temperature spectroscopic studies of acetylene (C_2H_2), ethane (C_2H_6), ethylene (C_2H_4), and propane (C_3H_8), with special emphasis on the 1.5-to-3 micron region (near-IR), which is accessible to ground-based observations. We report IR spectra for each phase at multiple temperatures, along with new measurements of the refractive index at 670 nm, determined in both the amorphous and crystalline phases. These new data have been used in a Kramers-Kronig (K-K) analysis to determine the real (n) and imaginary (k) components of the complex index of refraction for each hydrocarbon. One goal of the present work is to provide a data base of optical constants that can be used by the astronomical community, similar to the work of Hudgins et al. [3] and our recently published work on nitrile ices [4]. Measurements to determine the vapor pressure of each ice at several temperatures are in progress. These new results are relevant to the ongoing analysis of TNO spectra. Implications for the formation, stability, and detection of these hydrocarbons on TNO surfaces will be discussed.

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