C-H Hot Bands in the Near-IR Emission Spectra of the Leonids

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The infrared (IR) spectrum of interplanetary dust particles (IDP) as reported by Flynn *et al.* (2000) shows the signature of aliphatic -CH_2- and - CH_3 entities in form of ν_{CH} bands around 3.4 μm (2800-3000 cm^{-1}). Very similar ν_{CH} bands are observed in laboratory-grown MgO and natural olivine single crystals, suggesting polyatomic C_n-H units deeply imbedded in the mineral matrix. The discovery of these imbedded C_n-H units provide a possible interpretation for unassigned near-IR emission bands from 1999 Leonids extending from the 3.4 μm C-H stretching region to longer wavelengths, up to 4 μm as reported by Russell and Rossano (2000). IDP-like dust particles in the Leonids are the likely carriers of "organics," conventionally believed to form a veneer on the grain surfaces. During atmospheric entry and flash-heating such surface-exposed organics would be subject to near-instantaneous destruction. If the "organics" are imbedded, however, the C_n-H entities are protected and can become vibrationally excited to higher levels. By measuring the C-H vibrational manifold in absorption from the ground state (n=0) to the 5^{th} excited level, using hexane, we describe the C-H oscillator by a Morse potential and obtain the emission spectrum. The calculated positions of the (2-1) and (3-2) hot bands agree with the reported Leonid near-IR emission bands. Using flash heating of laboratory-prepared, finely divided dust it should be possible to verify this as yet tentative assignment.