absorption strength with rotational phase. It was unable to reproduce the exact shapes of the bands and the relative band strengths for a given phase. A better fit may be achieved by incorporating a particle size distribution within the frost.

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9.6

Topographic Relaxation on Ice-Covered Worlds: Application to Pluto

R.L. Marcialis (LPL/U. Arizona)

The subject of topographic relaxation through viscous flow has been addressed several times in the last 50 years, yet the case of a methane lithosphere has until now remained untreated. Lack of laboratory data on the creep behavior of methane is the major stumbling block to a rigorous analysis. Nonetheless, upper limits may be placed on the lateral extent of topography through use of simple scaling arguments. An empirical temperature-viscosity law for water ice has been restated in terms of melting temperature and assumed to hold for methane.

Using the approach of Parmentier & Head (1979) and the model of Lupo & Lewis (1980a,b), we demonstrate that the Maxwell time on Pluto can be as short as 30,000 years for topography with a characteristic radius of ~600 km. No features larger than ~10 km radius are expected to persist for more than 1 Gyr (5 Maxwell times).

Pluto is therefore expected to have a rather bland, spherical figure, supporting only slightly rolling topography. We find that the tendency for topography to persist in a low gravitational field is more than offset by a surface temperature (50-60 K) which is a significant fraction of methane's melting point. Any methane-coated planet within ~100 AU of the sun large enough to have undergone chemical differentiation is likewise expected to be deficient in significant topography unless it is very active tectonically.

References:

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