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Titan's Interior Chemical Composition: Possible Important Phase Transitions[1] MICHAEL HOWARD, Lawrence Livermore National Laboratory, JOSEPH ZAUG, BISHUN KHARE, CHRISTOPHER MCKAY, NASA Ames — We study the interior composition of Titan using thermal chemical equilibrium calculations that are valid to high pressures and temperatures. The equations of state are based on exponential-6 fluid theory and have been validated against experimental data up to a few Mbars in pressure and approximately 20000K in temperature. In addition to CHNO molecules, we account for multi-phases of carbon, water and a variety of metals such as Al and Fe, and their oxides. With these fluid equations of state, chemical equilibrium is calculated for a set of product species. As the temperature and pressure evolves for increasing depth in the interior, the chemical equilibrium shifts. We assume that Titan is initially composed of comet material, which we assume to be solar, except for hydrogen, which we take to be depleted by a factor 1/1000. We find that a significant amount of nitrogen is in the form of N_2, rather than NH_3. Moreover, above 12 kbars, as is the interior pressure of Titan, a significant amount of the carbon is in the form of graphite, rather than CO_2 and CH_4. We discuss the implications of these results for understanding the atmospheric and surface composition of Titan. .

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Michael Howard
Lawrence Livermore National Laboratory

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