

JOINT PHYSICS-ASTRONOMY-EPS COLLOQUIUM

November 24, 2008

Colloquium: 4:30pm, 1 Le Conte

Tea:: 4pm, in the 3rd Floor breezeway between Birge and Le Conte

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Recreating Core States of Giant Planets in the Laboratory

A new generation of condensed matter science

A breakthrough in studies of materials at high compressions, to ~ 100 -fold initial density, is underway thanks to experimental developments associated with achieving inertially confined fusion in the laboratory. The material states existing deep inside giant planets and brown dwarfs, and the hot-dense plasmas in stars like the Sun, are becoming accessible in the laboratory. Recent experiments show that at even a fraction of these compressions material behavior becomes somewhat exotic, with helium transforming to a metal at 2.5 g/cc, fluid carbon being a polymeric metal up to 2 TPa (20 Mbar), and aluminum exhibiting remarkable strength when "isentropically" compressed to 100 GPa (1 Mbar). These capabilities allow us to explore the nature of solids to several TPa, complex chemistry to 100 TPa (1 Gbar), and the nature of helium and hydrogen in the deep interiors of Jupiter and even super-giant exoplanets.