

Physics Department Colloquium

“Simple Elements at High Densities: En-Route to Metallic Hydrogen and Insulating Lithium”

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In this talk I shall discuss our high pressure experimental studies on the melt line of hydrogen, the superconducting phase diagram of lithium, and the physics of light elements at high densities. While hydrogen is predicted to dissociate and become a monatomic metal at very high densities, lithium is predicted to become unstable toward an insulating paired (diatomic) state; both are predicted to become superconductors with high transition temperatures. Neither of these states has been observed in the laboratory. A recently predicted peak in the temperature versus pressure melt line of hydrogen has been considered as a precursor for metallization. We have used an innovative technique to extend the melt line to high temperatures and pressures and observed a peak. In lithium, superconductivity under pressure was confirmed a few years ago by three groups including ours. We measured the superconducting phase diagram of lithium up to 0.8 megabars where the superconducting transition disappeared suggesting a possible move towards an insulating phase. An extension of these studies to higher pressures may reveal fascinating new physics.

Monday, April 13, 2009
4:00 PM in 334 JFB
Refreshments at 3:30 PM in 334 JFB