

Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

A superconductor to superfluid phase transition in liquid metallic hydrogen EGOR BABAEV, Cornell U., ASLE SUDBO, NTNU Trondheim, NEIL ASHCROFT, Cornell U — A superconductor to superfluid phase transition in liquid metallic hydrogen. Babaev (1,2), A. Sudbo (2), N. W. Ashcroft (1) (1) Cornell U. and (2) NTNU Trondheim, hydrogen is the simplest of atoms, it does not form the simplest of solids or liquids. Recent studies of the melting curve of hydrogen indicate that at high (but experimentally accessible) pressures, compressed hydrogen will adopt a liquid state, even at low temperatures. In reaching this phase, hydrogen is also projected to pass through an insulator-to-metal transition. This raises the possibility of new state of matter: a near ground-state liquid metal, and its ordered states in the quantum domain. Ordered quantum fluids are traditionally categorized as superconductors or superfluids; these respective systems feature dissipationless electrical currents or mass flow. Here we report an analysis based on topological arguments of the projected phase of liquid metallic hydrogen, finding that it may represent a new type of ordered quantum fluid. Specifically, we show that liquid metallic hydrogen cannot be categorized exclusively as a superconductor or superfluid. We predict that, in the presence of a magnetic field, liquid metallic hydrogen will exhibit several phase transitions to ordered states, ranging from superconductors to superfluids.

Egor Babaev
Cornell U.

Date submitted: 30 Nov 2004

Electronic form version 1.4