



THE CHINESE UNIVERSITY OF HONG KONG
Department of Physics
SEMINAR

Pressure-Tuned Structural and Electronic Instabilities in Quantum Materials

by

Professor F. Malte GROSCHE
Cavendish Laboratory, UK

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Time: 4:00 - 5:00 p.m.

Place: Rm G25, Science Centre North Block, CUHK

ALL INTERESTED ARE WELCOME

Abstract

Many complex materials display an interesting interplay between structural and electronic properties, which can be studied effectively under applied pressure:

Applied pressure turns the Mott insulator NiS_2 into a good metal. We have used high pressure quantum oscillation measurements to track the electronic Fermi surface and carrier mass in the correlated metallic state of pressure-metallized NiS_2 up to ~ 120 kbar.

If a continuous structural phase transition is suppressed to low temperatures, low-energy vibrational excitations can arise that cause a linearly temperature dependent electrical resistivity. In aperiodic high-pressure host-guest structures, such as that found in high-pressure bismuth, a low-energy sliding phonon mode is built in. Similar findings in high pressure antimony and in Nowotny chimney-ladder phases suggest that strongly damped low-frequency vibrations are essential to their thermodynamic and transport properties.

The Kondo lattice system CeSb_2 undergoes a pressure-induced structural transition. A heavy fermion state forms within the high-pressure structure. Mapping out its low-temperature phase diagram, we find that CeSb_2 superconducts over a narrow pressure range near a magnetic quantum critical point, and superconductivity is resilient to magnetic fields that exceed the Pauli limit by nearly an order of magnitude.