Vibrational Dynamics at High Pressure

John S. Tse
Department of Physics and Engineering Physics
University of Saskatchewan,
Saskatoon, Canada

Phonons are collective excitations of interacting particles in condensed matters. It is a manifestation of the elastic and vibrational properties of a material and play important role in many physical processes such as phase transition, thermal and electrical conductivity and superconductivity. A complete knowledge of phonon dispersion over a broad range of momentum transfer (*i.e*. both the direction and magnitude of propagating phonons) will fully define the atomic dynamics of a system. The availability of momentum-resolved low-energy excitation techniques of sub meV resolution offers new and exciting opportunities in the investigation on the dynamics of atomic metals and liquids at high pressure. For example, measurements of the velocity of sound, phonon frequency and phonon linewidth with provide indispensable information in the understanding of the underlying physics on topics related to high pressure elemental solids such as the much debated liquid-liquid transitions, recently discovered unusually large amplitude anharmonic atomic vibrations in crystalline solids and the role of electron-phonon interactions in superconductors, respectively. In this presentation, I will illustrate each phenomenon with examples and discuss how the next generation of high resolution inelastic scattering experiments may help to address some of the key issues.