



Weekly Seminar

Plastic Deformation in a Quantum Solid: Dislocation Avalanches and Creep in Helium

Zhigang Cheng

Institute of Physics, Chinese Academy of Sciences



Time: 16:00pm, March. 28, 2018 (Wednesday)

时间: 2018年3月28日 (周三) 下午 16:00

Venue: Room W563, Physics Building, Peking University

地点: 北京大学物理楼 西563

Abstract

Conventional solids deform elastically for small stresses - reversibly with a linear, rate-independent relationship between stress and strain. Beyond the yield point, plastic deformation begins - irreversible, nonlinear and time dependent. Plasticity involves the motion and multiplication of dislocations and in this talk I will report our recent observations of such “metallurgical” phenomena in a solid whose defect behavior is dominated by quantum effects - hcp ^4He , whose zero-point motion is magnificently larger than conventional solids. Below 0.4 K, there is a strain threshold for elastic deformation above which sudden stress drops and acoustic emissions (AE) appear – the signatures of dislocation avalanches. The dimensions of these slip events range from mm to μm . The smallest slips are consistent with ballistic motions of dislocations. At higher temperatures the avalanches are replaced by continuous creep involving dislocations and we observe steady flow at stresses as low as 400 Pa.

About the Speaker

Zhigang Cheng received his bachelor in physics from Wuhan University in 2006 before moving to Pennsylvania State University. His graduate research focused on thermodynamic properties of solid helium in confined geometry. After receiving his PhD from Penn State, he moved to University of Alberta as a postdoctoral fellow in 2013. His research in Alberta focused on mass transport in solid ^4He and elasticity of solid ^3He . He started his faculty career at Institute of Physics, Chinese Academy of Sciences since September 2017.