北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Seminar

The birth of plasmons at epsilon near zero

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Venue: Room W563, Physics building, Peking University

地点：北京大学物理楼，西563会议室

Abstract

Metals are solid state, free-electron plasmas, whose large negative dielectric function causes the metallic reflectivity; the collective plasmonic response of free electrons prevents the electromagnetic penetration into a metal. When the real part of the dielectric response inevitably passes through zero, however, the electromagnetic fields cannot be screened, and pass through metals as charge density waves, or bulk plasmons. Even though the epsilon near zero (ENZ) condition is common to all metals, it has hardly been explored by optical or nonlinear optical techniques. It is established, however, that the nonlinear response at ENZ is nonperturbative, and high-order nonlinear responses are strongly enhanced. Silver is one of the most commonly used plasmonic materials, yet its bulk plasmon response at ENZ, from which all other plasmonic properties derive, has not been investigated. I will present our recent results on the two-photon photoemission (2PP) of Ag(111), Ag(100), and Ag(110) surfaces. We find that the 2PP spectra exhibit pronounced plasmonic features starting from the ENZ region that cannot be explained within the current models for interactions among photons, electron-hole pairs, and plasmons.

Speaker

Prof. Hrvoje Petek is the RK Mellon Chair Professor at the University of Pittsburgh. He received his B.S. in 1980 at Massachusetts Institute of Technology, and Ph.D. in 1985 at University of California, Berkeley. In 2000, he became a Professor of Physics, and later Professor of Chemistry, at the University of Pittsburgh. He was elected as a Fellow of the American Physical Society in 2003. In 2014, he was appointed as the Richard King Mellon Chair Professor of Physics and Astronomy, the most prestigious professor Chair at the University. In 2016, he was elected as a fellow of American Association for the Advancement of Science. In 2019, he was awarded with the Ahmed Zewail Award in Ultrafast Science and Technology of the American Chemical Society, the most important award in the field of ultrafast dynamics. Dr. Petek's research interests focus on nonequilibrium electronic phenomena at surfaces, interfaces and in solids; ultrafast plasmonics in metallic nanostructures; ultrafast microscopy of coherent excitations in solids and the Surface femtochemistry and photocatalysis. He is a pioneer in the coherent ultrafast microscopy and microscopy of solid-state materials. From 2006, he has been the Editor-in-Chief of Progress in Surface Science.