北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Weekly Seminar

Exploiting quantum plasmonics for enhanced functionalities of low-dimensional heterostructures

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Time: 3:00pm, Mar. 30, 2022 (Wednesday)

时间: 2022年3月30日 （周三）下午3:00

腾讯会议链接：https://meeting.tencent.com/dm/DkKzKDoSLca3

腾讯会议ID：512-785-113

Abstract

In systems of reduced dimensionality containing metals as constituent building blocks, the pertinent conduction electrons are quantum mechanically confined, and their collective excited states of motion are termed plasmons. Recent research has witnessed intensive efforts on exploiting the rich quantum nature of plasmonic excitations in a wide variety of systems and processes, including photon entanglement, solar energy harvesting, electron dephasing, and catalysis, to name a few. In this talk, we will briefly review situations where the quantum nature of plasmons is bound to play a vital role. Then we will use a few recent examples to demonstrate how quantum plasmonics can be exploited to enhance the overall performance of low-dimensional heterostructures for optimal functionalities. Our first example is the enhanced energy transfer between plasmons and excitons in the strongly coupled regime known as plexcitons. The next example is the demonstration and understanding of drastically enhanced phase coherence of the electron transport in graphene proximity coupled with a plasmonic system. The third example is drawn from our recent studies of emergent plasmonic excitations in hybrid two-dimensional Dirac electrons of graphene and three-dimensional topological insulator. Time permitting, we will show in the last example how plasmons can join force with phonons in enhancing the superconducting transition temperatures of interfacial superconductors and beyond.

About the speaker

张振宇，中国科学技术大学杰出讲席教授及严济慈讲席教授。1982年本科毕业于武汉大学，1989年获美国Rutgers大学博士学位(CUSPEA项目)。1995-2010年任职于美国橡树岭国家实验室（研究员至杰出研究员），1997-2011年兼任美国Tennessee大学(教授至讲席教授)，2011年初全职回科大。长期从事凝聚态理论研究，致力于原子尺度微观生长机理，新材料预言及物性优化，注重理论与实验互动合作。近期研究重心包括层状材料、界面超导、拓扑超导、量子反常霍尔效应、量子等离激元等。共发表SCI论文310余篇，邀请报告与学术讲座300余次。 1998年当选美国物理学会会士，曾任两届PRL凝聚态物理副主编，现任SCPMA等学术期刊编辑。