物理与电子学院青年科协　　2017年度省重点实验室学术报告 (16)

Programmable quantum emitter arrays and spin-orbit coupled superlattices of moirè excitons

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报告摘要：

Highly uniform and ordered nanodot arrays are crucial for high performance quantum optoelectronics including new semiconductor lasers and single photon emitters, and for synthesizing artificial lattices of interacting quasiparticles towards quantum information processing and simulation of many-body physics. Van der Waals heterostructures of 2D semiconductors are naturally endowed with a strictly ordered nanoscale landscape, i.e. the moiré pattern that laterally modulates electronic and topographic structures. Here we find these moiré effects realize superstructures of nanodot confinements for long-lived interlayer excitons, which can be either electrically or strain tuned from perfect arrays of quantum emitters to excitonic superlattices with giant spin-orbit coupling. Besides the wide range tuning of emission wavelength, the electric field can also invert the spin optical selection rule of the emitter arrays. When complex-hopping couples nanodots into honeycomb superlattices, the exciton bands feature a Dirac node and two Weyl nodes, connected by spin-momentum locked topological edge modes. With the observed long lifetime and spin dependent interaction, these moiré excitons provide an exciting Bose-Hubbard system with versatile controllability for exploring exotic quantum phases.

报告人简介：

俞弘毅，博士，香港大学。2004年毕业于北京大学物理系，获学士学位。2010年毕业于中国科学院物理研究所，获博士学位。2010年至2015年在香港大学从事博士后研究工作，2015后转为研究助理教授。目前主要研究兴趣包括在二维层状半导体中的能谷、自旋物理，以及冷原子和固体核自旋系统的量子态工程与计量。近年来在Nature Physics、Nature Commun、Phys. Rev. Lett等国际顶尖期刊上发表论文30余篇。多次应邀在包括APS March Meeting等国际学术会议上报告工作。

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