北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Weekly Seminar

Magnetic texture based magnonics and its applications

Jiang Xiao

Fudan University

Time: 3:00pm, May 19, 2021 (Wednesday)

时间: 2021年5月19日 （周三）下午3:00

Venue: Room W563, Physics building, Peking University

地点: 北京大学物理楼, 西563会议室

Abstract

As a collective quasiparticle excitation of the magnetic order, spin wave can propagate in both conducting and insulating materials with little dissipation. Magnetic material with non-trivia magnetic texture provides a unified information memory and processing platform. We demonstrate that, in the presence of Dzyaloshinskii-Moriya interaction, an antiferromagnetic domain wall acts as a spin wave polarizer or a spin wave retarder. Based on the same principle, the spin wave driven domain wall motion in antiferromagnet also strongly depends on the linear polarization of the injected spin waves. Utilizing this interplay between the spin wave and the magnetic textures, we construct a universal spin wave logic gate, which can realize all unary and binary logic operation in one single hardware structure. Based on the universal spin wave gate, we illustrate a full functional spin wave computer.

Apart from its capability in manipulating spin waves, magnetic textures can also be applied in other fields, such as energy and neuromorphic computing. We will illustrate an example of realizing solid state energy storage based on topological magnetic texture, and an example of constructing a Hopfield neural network based on magnetic texture with stripe domains.

About the speaker

Prof. Jiang Xiao received his B. S. in Physics from Peking University in 2001, and Ph. D. from Georgia Institute of Technology in 2006. After a postdoctoral research in Kavli Institute of NanoScience at Delft University of Technology in The Netherlands, he joined Fudan University in 2009. His research is on the theoretical condensed matter physics, and focuses on spintronics, including spin transport in magnetic nanostructures, magnetization dynamics, parametric spin pumping, and more recently on magnonics, cavity spintronics, and spin-based neuromorphic computing.