THE PHYSICS COLLOQUIUM

Thursday 12 December 2024, 4:00 p.m.
Nijenborgh 4, Lecture Hall 5111.0080

Time-domain studies of electronic Interactions: From electron-phonon coupling to engineering magnetism

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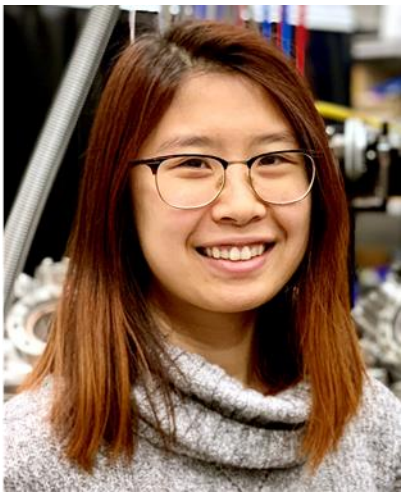

Electronic interactions, such as electron-phonon coupling and spin-orbit interactions, fundamentally shape the physical, electronic, and magnetic properties of materials. Understanding and manipulating these interactions is key to engineering novel material phases and dynamic phenomena. Angle-resolved photoemission spectroscopy (ARPES), extended into the time domain through pump-probe techniques, provides a powerful approach to disentangle and study these interactions by naturally separating their contributions on ultrafast timescales. First, we demonstrate how time-resolved ARPES (TR-ARPES) enables the mode-projected study of electron-phonon interactions in graphite. By tracking quantized energy-loss processes corresponding to the emission of strongly coupled optical phonons, we extract microscopic matrix elements that provide direct insights into two-body scattering events between electrons and phonons.

In addition to studying electronic interactions, we can also leverage particular interactions to manipulate material properties. In a second work, we explore the ability to engineer the magnetic ground state and dynamical magnetic properties through the selective activation of Ni ions. Nickle's large unquenched orbital angular momentum couples efficiently to magnons through spin-orbit coupling. Even a 10% doping of Ni ions can significantly alter the ground state of the XPS3 family of antiferromagnets. Moreover, resonant photoexcitation of Ni ions can generate magnons in a variety of antiferromagnetic ground states. Our results show that leveraging specific electronic interactions is an effective way to engineer magnetic properties in complex quantum materials.

Join us for coffee starting 3:30 p.m. Refreshments will be served after the lecture.

For more information contact the host: Antonija Grubisic Cabo (a.grubisic-cabo@rug.nl)
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