



# Department of Physics Colloquium

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3:00 PM

## Exploring Itinerant Ferromagnetism: From Puzzle Games to Correlated Quantum Phenomena

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Itinerant ferromagnetism in materials, characterized by the complex interplay of electron correlations, represents a fundamental quantum phenomenon in condensed matter physics. Despite the prevalence of ferromagnetic metals, deciphering the microscopic origins and magnetic phase transitions of such materials remains a formidable challenge. These materials often exhibit active orbital degrees of freedom with Hund's coupling; however, the local Hund's rule does not necessarily explain the ferromagnetic long range order. In this colloquium, we delve into the intricate mechanisms behind itinerant ferromagnetism using non-perturbative approaches, incorporating graph theory, analytical analysis, and sign problem-free Monte Carlo simulations, to examine the ground state, thermodynamic properties, and magnetic phase transitions of itinerant electrons in single and multi-orbital systems, as well as in flat band scenarios. Our discussion aims to illuminate the path towards understanding and identifying novel itinerant ferromagnetic states, thereby supporting the experimental quest for discovering new materials with such intriguing properties.

This colloquium will be held in-person, in SERC 116