

Development of Entangled Probe Scattering with Neutrons

Tuesday, 25 February 2025 14:20 (20 minutes)

One of the key roles that CANS facilities play in the international neutron ecosystem is providing the abundant beam time necessary for developing novel ideas in neutron instrumentation. Over the last two decades, LENS has devoted considerable effort to the development of spin manipulation devices, in particular the Magnetic Wollaston Prisms that have been used for various spin-echo techniques for high-resolution diffraction, direct measurements of projected density-density correlation functions, dark-field radiography among other techniques. We have recently demonstrated that such devices create mode-entangled states of neutrons. Viewed in this light, the high resolution obtained by SE techniques is seen as an example of quantum-enhanced sensing exploiting an interferometric approach, and we have embarked on an effort to explore the physics that may be investigated with such beams. The talk will review the development of the instrumentation and applications along with describing recent results from experiments performed at international-scale facilities using these ideas.

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Funding Agency

US Department of Commerce, US Department of Energy

Abstract classification - track type

Applications

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Session Classification: Session 5