QPhysics AT QUEENS COLLEGE

Colloquium Notice

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Superfluid Transport in Quantum Spin Chains

Spin superfluids enable long-distance spin transport through classical ferromagnets by developing topologically protected defects in the magnetic texture. For small spins, in which the magnetization takes quantized values, the topological protection suffers from strong quantum fluctuations. We study the remanence of spin superfluidity inherited from the classical magnet by considering the two-terminal spin transport through a finite spin-1/2 ferromagnetic chain with planar exchange. In the absence of anisotropy in the exchange or an applied magnetic field, the spectrum is gapless. There exist zero-energy domain-wall modes that rotate within the plane of the exchange interaction and are the analogue of the topological defects found in classical magnets. If the system is ordered by an exchange anisotropy, the spectrum is gapped and there exist zero-energy modes localized to the ends of the ferromagnetic chain which are guaranteed by topological properties of the bulk spectrum. We find zero-energy domain-walls, polarized perpendicular to the anisotropy, incident on an ordered chain are reflected as domain-walls polarized in the opposite direction. Furthermore, a domain-wall polarized within the plane of the exchange can be ballistically transmitted through the same magnetic chain of a resonant length. This resonant length depends linearly on the applied magnetic field so that, for a fixed length of chain, the transmission of domain-walls can be tuned by the magnetic field.

Friday
August 31, 2018
Starts at 12:15 PM
Coffee at 12:00 PM
Physics Conference Room, SB B326