Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **3894** Type: **Oral Competition (Undergraduate Student) / Compétition orale (Étudiant(e) du 1er cycle)**

(U*) Order by Quantum Disorder in the Heisenberg-Compass Model on the Square Lattice: A Perspective from Exact Diagonalization

Monday 19 June 2023 12:00 (15 minutes)

The Heisenberg-compass model on a square lattice offers a simple example of a frustrated magnet that exhibits the phenomenon of order by disorder (ObD). In this system the ordering direction is selected by quantum zero-point fluctuations for much of the phase diagram, providing a minimal context to explore manifestations of ObD, such as the presence of a pseudo-Goldstone gap. We explore the Heisenberg-compass model by exact diagonalization on small clusters. By employing translation symmetries of the model, ground state properties, including energies and correlation functions, are studied for clusters of up to 25 spins. We find a phase diagram qualitatively consistent with the classical result, identifying the magnetic ordering pattern via the spin-spin correlation functions. The low-lying spectrum, specifically the evolution of the spin-wave gap, will be presented as a function of the Heisenberg and compass exchanges. We find good agreement between the exact diagonalization results and semi-classical expectations from non-linear spin-wave theory.

Keyword-1

Quantum Magnetism

Keyword-2

Order by Disorder

Keyword-3

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Session Classification: (DCMMP) M1-7 Quantum Magnetism | Magnétisme quantique (DPMCM)

Track Classification: Technical Sessions / Sessions techniques: Condensed Matter and Materials Physics / Physique de la matière condensée et matériaux (DCMMP-DPMCM)