

Chez Pierre

Presents ...

Tuesday, November 28, 2023

12:00 pm -1:00 pm

Duboc Room – 4-331



Special Chez Pierre Seminar

Cristian Batista, University of Tennessee, Knoxville (UTK)

“Dynamical structure factor of the triangular Heisenberg model”

I will discuss recent inelastic neutron scattering experiments conducted on $S=1/2$ triangular lattice Heisenberg antiferromagnets (TLHA). These experiments have revealed significant deviations from the dynamical spin structure factor $S(\mathbf{q},\omega)$ predicted by non-linear spin wave theory (NSWT). Despite the ability of semi-classical theories to accurately predict the field-induced magnetic orderings of the $S=1/2$ nearest-neighbor TLHA, including the well-known 120-degree ordering at zero field, the excitation spectrum revealed by $S(\mathbf{q},\omega)$ is not captured by a low-order $1/S$ expansion. This failure of semi-classical theories can be attributed to the proximity of this model to a quantum critical point beyond which the 120-degree ordering melts into quantum spin liquid state. In this regime, magnons are more accurately described as two-spinon bound states, which can be captured by a Schwinger Boson approach only when Gaussian ($1/N$) fluctuations are included [1-4]. The two-spinon bound states arise from the coupling of the spinons to fluctuations of the auxiliary (gauge) fields. The composite nature of the magnon modes is accompanied by a multi-spinon continuum, extending beyond the two-magnon bandwidth. This theoretical framework successfully explains several aspects of the inelastic neutron scattering data observed in $\text{Ba}_3\text{CoSb}_2\text{O}_9$ [4] and aligns with recent measurements conducted on KYbSe_2 [5,6]."

[1] E. A. Ghioldi, et al., Phys. Rev. B **98**, 184403 (2018).

[2] Shang-Shun Zhang, E. A. Ghioldi, Yoshitomo Kamiya, L. O. Manuel, A. E. Trumper, and C. D. Batista, Phys. Rev. B **100**, 104431 (2019).

[3] Shang-Shun Zhang, E. A. Ghioldi, L. O. Manuel, A. E. Trumper, and Cristian D. Batista, Phys. Rev. B **105**, 224404 (2022).

[4] E. A. Ghioldi, Shang-Shun Zhang, Yoshitomo Kamiya, L. O. Manuel, A. E. Trumper, and C. D. Batista, Phys. Rev. B **106**, 064418 (2022).

[5] A. O. Scheie *et al.*, arXiv:2109.11527 (Nature Physics in press).

[6] A. O. Scheie *et al.*, arXiv:2207.14785.