CLARK UNIVERSITY

Gustaf H. Carlson School of Chemistry and Biochemistry
Seminar Series – Spring 2019

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Emergent Quantum Critical Phenomena in a Low-dimensional Molecular Antiferromagnet

Quantum magnets have proved to be fertile ground for studying new types of quantum many-body states. Of particular interest are critical quantum phenomena near quantum phase transitions. In this talk, I will first introduce neutron scattering technique as a powerful tool to probe the exotic quantum phenomena in quantum spin systems. After that, I will present the recent neutron scattering studies on a novel spin-1/2 two-dimensional coupled ladder molecular antiferromagnet (dimethylammonium)(3,5-dimethylpyridinium)$CuBr_4$ ($C_9H_{18}N_2CuBr_4$) [1], abbreviated as DLCB. I will show that DLCB is close to a quantum critical point in two dimensions at zero field and ambient pressure [2]. Moreover, in conjunction with theoretical calculations, our results show the exotic quantum effects in spin dynamics including evidences of the field-induced spontaneous (T=0 K) magnon decay in an applied transverse magnetic field [3] and observation of Higgs-like amplitude mode [4], which is characterized by amplitude fluctuation of the order parameter and roughly analogous to the Higgs boson in particle physics. Our work provides much-needed experimental insights to the understanding of these intriguing quantum many-body effects in low-dimensional antiferromagnets.

Friday, March 8, 2019
12:15 P.M.
Sackler Sciences Building, Room S122
Luncheon at 11:45 A.M., Room S325

References:
[1] Awwadi *et al*., Inorg. Chem. **47**, 9327 (2008).
[2] Hong *et al*., Phys. Rev. B **89**, 174432 (2014).
[3] Hong *et al*., Nat. Commun. **8**, 15148 (2017).
[4] Hong *et al*., Nat. Phys. **13**, 638 (2017).

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