25 de MAYO de 2022

12.30 h
AULA del edificio de I+D+i (Campus Río Ebro)

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Surprises when exploring electronic correlated systems at intermediate couplings: spirals, Majoranas, and pairing

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Recent results in the area of many-body physics will be discussed. In particular, employing computational techniques, I will address the several surprising states that emerge in regions of parameters space with competing tendencies. Specifically, I will first focus on low dimensional chains and ladders, where the density matrix renormalization group technique is an accurate tool. For this reason, without the bias inevitable of mean field or variational approximations, the computer can reveal a variety of exotic phases difficult to anticipate. This new states involve spin staggered arrangements of ferromagnetic blocks [1], as well as spirals that become the ground state at intermediate range couplings [2], without any obvious source of frustration. Predictions for inelastic neutron scattering for block states will be presented and discussed [3]. In the context of these spirals, coupling them to a canonical s-wave superconductor induces in the spiral both a singlet and triplet pairing components and, more interestingly, Majorana states at the edges [4]. This type of spirals, now in two dimensions, can also originate when including spin-orbit coupling and a magnetic field, creating a regularly spaced array of skyrmions, called "skyrmion crystal" [5]. This crystal can also be a platform for Majoranas [6]. Finally, time allowing, I will discuss progress with regards to pairing in multi-orbital models, employing a two-orbital Hubbard version of the Haldane chains [7], as well as low dimensional versions of models for iron superconductors [8]. *Work supported by the US Department of Energy (DOE), Office of Science, Basic Energy Sciences (BES), Materials Sciences and Engineering Division.*

[1] See for example N. Patel et al, Commun. Phys. 2, 64 (2019); M. Sroda, E. Dagotto, and J. Herbrych, PRB 104, 045128 (2021), and references therein; [2] J. Herbrych et al, Proc. Natl. Acad. Sci. USA 117, 16226 (2020); [3] J. Herbrych et al., Nat. Comm. 9, 3736 (2018), J. Herbrych et al. PRB 102, 115134 (2020); [4] J. Herbrych et al, Nat. Comm. 12, 2955 (2021); [5] N. Mohanta et al., Phys. Rev. B 100, 064429 (2019) (Editor' s choice). See also N. Mohanta et al., Commun. Phys. (Nature) 3, 229 (2020); [6] N. Mohanta et al., Commun. Phys. (Nature) 4, 163 (2021); [7] N. D. Patel et al., npj Quantum Mater. 5, 27 (2020); [8] B. Pandey et al., PRB 103, 214513 (2021) and references therein.

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