Bulletin of the American Physical Society

2024 APS March Meeting
Monday–Friday, March 4–8, 2024; Minneapolis & Virtual

Session T01: Nematicity, Correlations and Pairing
11:30 AM–1:18 PM, Thursday, March 7, 2024
Room: L100A

Sponsoring Unit: DMP
Chair: Qing-Ping Ding, Ames National Laboratory

Abstract: T01.00006 : Spin and orbital degrees of freedom in FeSe (Part-II): field-theory perspective*

12:30 PM–12:42 PM

← Abstract →

Presenter:
Piotr Chudzinski
(Institute of Fundamental Technological Research PAS)

Authors:
Piotr Chudzinski
(Institute of Fundamental Technological Research PAS)

Myrta Gruening
(Queen's University of Belfast)

Abyay Ghosh
(Queen's University Belfast)

Motivated by our recent ab-initio results we propose an effective field-theory model for coupled spin and orbital degrees of freedom in FeSe. Both degrees of freedom are considered to be classical 2D quantities, thus the Kosterlitz-Thouless theory of collective modes applies. We first study how small momenta fluctuations renormalize DFT bands and then we move on to topological large momentum excitations, vortexes. The DFT study revealed that we need to develop a Renormalization Group (RG) method which, simultaneously with a relevance of usual instabilities, can capture formation of vortex crystal (VC) phase. We achieve it by incorporating vortex-vortex interactions. This allows us to derive a phase diagram including VC together with effects of the standard instabilities. The theoretical method that we developed will be useful not only for the specific case of FeSe but also for other systems where large vortex fugacity regime is reachable. However advantage of FeSe is that here the RG results can be experimentally tested: they enabled us to build a bridge between our former DFT results (that works best assuming a presence of magnetic phase) and experimental measurements (which had revealed the presence of magnetism only for a finite pressure).

*Engineering and Physical Sciences Research Council (UK) grant EP/V02986X/1;European Union's Horizon 2020 research and innovation program grant no. 847639;