TECHNISCHE UNIVERSITÄT DRESDEN

IFMP Institut für Festkörper- & Materialphysik

IFMP Seminar

Date: Tuesday, May 18, 2021, at 14:50

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Speaker: **Elena Gati**

MPI-CPfS

Title: **Hydrostatic and uniaxial pressure tuning of quantum materials: From iron-based superconductors to quantum magnetism**

Abstract: The last years have brought tremendous advances in applying hydrostatic and uniaxial pressure to quantum materials as well as in probing their properties under those extreme conditions. This has opened the possibility to explore entirely new phase space that so far has not been accessible. Here, I will discuss how these new opportunities have improved our understanding of quantum phases in selected candidate materials.

I will first focus on our investigations of the interplay of superconductivity with magnetism and nematicity in iron-based superconductors [1]. Specifically, I will discuss our revision of the temperature-hydrostatic pressure phase diagram of FeSe [2] using a home-built specific heat under pressure apparatus [3], and will compare and contrast these findings to phase diagrams of other high-temperature superconductors. Also, I will introduce our new technical development of combined hydrostatic and uniaxial pressure [4], which will allow the study of the interaction between nematicity and superconduc-tivity by fine tuning iron-based superconductors across putative quantum critical points.

The second part is focused on hydrostatic pressure tuning of ferromagnetism in the localized and itinerant limits, respectively. In the search for semiconducting, exfoliable ferromagnets, the van-der-Waals ferromagnet VI_3 recently attracted a lot of attraction. By applying hydrostatic pressure, we were able to show that VI_3 exhibits a complex phase diagram [5], which is characterized by strong magnetoelastic effects. For itinerant ferromagnets, disorder is known to crucially change the properties close to zero temperature. This makes the use of pressure as a clean tuning parameter very important to understand the generic avoidance of quantum criticality. In this context, I will present our recent results on the candidate system $LaCrGe_3$ [6] and show that this material shows a new type of avoided criticality.

Throughout the talk, I will highlight prospective venues for uniaxial pressure tuning at the MPI CPfS.

[1] Gati *et al.*, Ann. Phys. **532**, 2000248 (2020).
[2] Gati *et al.,* Phys. Rev. Lett. **123**, 167002 (2019)
[3] Gati *et al.*, Rev. Sci. Instrum. **90**, 023911 (2019).
[4] Gati *et al.,* Rev. Sci. Instrum. **91**, 023904 (2020).
[5] Gati *et al.,* Phys. Rev. B **100**, 094408 (2019) (Editor's suggestion).
[6] Gati *et al.,* Phys. Rev. B **103**, 075111 (2021) (Editor's suggestion).

Host: H.-H. Klauß