Contribution ID: **23** Type: **Talk**

Tuning and understanding correlated quantum phases of layered materials

Wednesday 22 November 2023 11:30 (30 minutes)

The classification and deep understanding of phases of quantum matter is a necessary premise for utilizing quantum materials in all areas of modern and future electronics in a controlled and optimal way. In this respect, layered systems with highly anisotropic electronic properties have been found to be potential hosts for rich, unconventional and tunable exotic quantum states. Prominent classes of layered materials are cuprates, transition metal dichalcogenides (TMDs) and kagome-lattice systems.

In this talk, I will provide brief overview of systems, from different material classes, with novel electronic and magnetic properties, where the application of temperature, magnetic field, hydrostatic pressure, and uniaxial strain lead to large and unexpected effects. These include the topological kagome magnet $TbMn_6Sn_6$ [1] (where we show that the topological electronic properties tied to the spin-polarized Dirac dispersion is promoted only by true static out-of-plane ferrimagnetic order and is washed out by the slow commensurate magnetic fluctuations), the topological kagome metals AV_3Sb_5 (A=K,Rb) [2-4] (where we found intertwining of a TRSB charge ordered state with tunable unconventional superconductivity), the cuprate system $La_2 - x Ba_x CuO_4$ [5] (where an extremely low uniaxial stress of 0.1 GPa induces a dramatic rise in the onset of 3D superconductivity), and superconducting TMDs 2H-NbX_2 (X=Se,S) [6] (where a strong strain/hydrostatic pressure effect on the superfluid density and its unconventional scaling with the critical temperature were observed). I will discuss these results using a combination of muon-spin rotation under pressure/strain/field, magnetization, transport, and diffraction techniques.

[1] Mielke et. al., and Guguchia, Communications Physics **5**, 107 (2022).

[2] Mielke et. al., and Guguchia, Nature **602**, 245-250 (2022).

[3] Guguchia et. al., Nature Communications **14**, 153 (2023).

[4] Guguchia et. al., NPJ Quantum Materials **8**, 41 (2023).

[5] Guguchia et. al., Physical Review Letters **125**, 097005 (2020).

[6] Rohr et. al., and Guguchia, Science Advances **5(11)**, eaav8465 (2019).

Author: GUGUCHIA, Zurab (PSI - Paul Scherrer Institut)

Presenter: GUGUCHIA, Zurab (PSI - Paul Scherrer Institut)

Session Classification: Morning Session