INTERNSHIP PROPOSAL

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Thesis possibility after internship: YES
Funding: no secured funding (EDPIF competition)

Local investigation of a magnetic topological kagome metal by NMR

Metallic compounds with a kagome lattice, made of corner-sharing triangles, are gaining increasing interest in condensed matter [see e.g. Wang Q. et al, arXiv:2409.04211]. This is due first to their unique non-trivial band structure, which encompasses Dirac crossing points, a flat band and Van-Hove singularities even at the simplest nearest-neighbor tight-binding approximation. Beyond electronic states with potentially non trivial topology, the recently discovered materials often also show signs of strong electronic correlations with magnetic ground states or even superconductivity. Thus, kagome metals provide a rare opportunity to combine strong correlation and topology to generate new quantum states.
One such recent material is $Co_3Sn_2S_2$, which stands out for the presence of Weyl fermions near the Fermi energy and its large anomalous hall effect. It possesses a rather simple ferromagnetic ground state but a much debated, more complex, magnetic behavior just below T_C ~170K. Understanding the magnetism in this material and its interplay with the topological properties is one current hot topic.

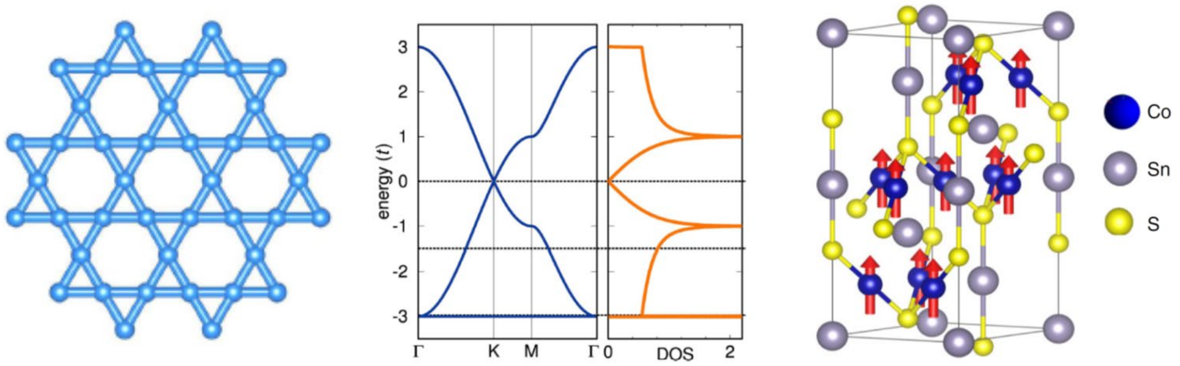

*Figure: (left) the kagome lattice and (center) its band structure in a nearest-neighbor tight-binding model (*Guterding, D. *et al Sci. Rep.* **6**, 25988 (2016)). (right) Cristal structure of the ferromagnetic $Co_3Sn_2S_2$ kagome compound (Guguchia Z. et al, *Nat Commun* **11**, 559 (2020))

We propose to use NMR as a local probe of the magnetic and electronic properties of pure and In doped $Co_3Sn_2S_2$. As a local technique, NMR is well-suited to unravel the bulk electronic behavior and detect the possible coexistence of different phases as debated in the literature.

Keywords: quantum materials, electronic correlations, topology, nuclear magnetic resonance
Competence: Good fit for experiments and good background in solid state physics

Condensed Matter Physics:	YES	Soft Matter and Biological Physics:	NO
Quantum Physics:	YES	Theoretical Physics:	NO