

IFMP Seminar

Date: Tuesday, November 09, 2021, at 14:50

Room: REC/C213 (if possible)

BigBlueButton:

<https://selfservice.zih.tu-dresden.de/link.php?m=152129&p=59e354ae> (TUD)

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Speaker: **Pascal Puphal**
MPI-FKF, Stuttgart

Title: **Frustrated Magnetism in the Kagome Lattice**

Abstract: Quantum spin systems with Cu^{2+} ions are suitable materials to study quantum many-body effects under variable conditions. Prominent examples are low-dimensional materials with strong magnetic frustrations. A quantum spin-liquid (QSL) realizes no static magnetic order, despite sizeable magnetic interactions. Compounds with decoupled antiferromagnetic kagome layers are prototypical systems to search for an experimental realization of the quantum spin-liquid state as first found in Herbertsmithite, $\text{ZnCu}_3(\text{OH})_6\text{Cl}_2$ [1]. The dominant magnetic interaction in Herbertsmithite is caused by Cu–O–Cu antiferromagnetic superexchange with an exchange energy of $J=17$ meV, but no magnetic long-range order has been observed down to $T = 50$ mK.

One structural drawback of Herbertsmithite is the intrinsic Zn–Cu-antisite disorder, which makes it challenging to achieve a structurally perfect $\text{ZnCu}_3(\text{OH})_6\text{Cl}_2$ crystal.

From this point of view, novel kagome systems with highly ordered crystal structures are essential to uncover the intrinsic properties of the kagome antiferromagnet. In addition, the frontier of Herbertsmithite is chemical doping since Mazin et al. have proposed that a correlated Dirac metal can be found in electron-doped Herbertsmithite, which might be realized by replacing Zn by a trivalent ion [2].

In my talk, I will start with the introduction of the QSL candidate Herbertsmithite going to new variants with trivalent substitutions on the Zn site, which gives rise to a new class of highly frustrated kagome systems [3,4,5].

[1] Tian-Heng Han *et al.*, Nature 492, 406–410 (2012).

[2] I. I. Mazin *et al.*, Nature Comm 5, 4261 (2014).

[3] Q. Barthelemy *et al.*, PRM 3, 074401 (2019).

[4] P. Puphal *et al.*, J. of Mat. Chem. C 5, 2629-2635 (2017).

[5] P. Puphal *et al.*, Phys. Status Solidi B 1800663 (2019).