

CONDENSED MATTER THEORY SEMINAR

Subject: **Low temperature thermal transport in α -RuCl₃**

Speaker: **Dr. Jan Bruin (MPI for Solid State Research, Stuttgart)**

Date & time: **Friday, June 10th, 2022 at 3:15 p.m.**

Zoom Link:

<https://uni-frankfurt.zoom.us/j/96520912647?pwd=NWZneE5XQmlwZFJlUXJpcUhdNEtKQT09>

α -RuCl₃ has been identified as an intriguing platform for studying Kitaev quantum spin liquid physics, with a field-induced state exhibiting the quantized thermal Hall effect, interpreted as the signature of an edge mode of fractionalised Majorana fermions [1]. A surprising recent result claims that it may host a 3D Fermi surface of neutral quasiparticles, giving rise to quantum oscillations of the thermal conductivity [2]. However, many fundamental material properties are still under debate, including the reproducibility of low temperature thermal transport and even the low temperature crystal structure including the role of stacking faults [3].

In this talk, I will present our recent thermal Hall and thermal conductivity studies on α -RuCl₃. We observed a large thermal Hall effect over a wide range of temperatures and fields, with a magnitude consistent with half-quantization [4]. However, k_{xy}/T is suppressed at low temperature, and we discuss to what extent it can be said to exhibit a 'plateau'. We also report a sequence of field-dependent features in thermal conductivity, where detailed analysis shows that they are not quantum oscillations but likely caused by magnetic transitions in secondary crystal phases, such as stacking faults [5].

[1] Y. Kasahara et al., Nature **559**, 227 (2018)

[2] P. Czajka et al., Nature Physics **17**, 915 (2021)

[3] e. g. H.B. Cao et al., PRB **93**, 134423 (2016)

[4] J.A.N. Bruin et al., Nature Physics **18**, 401 (2022)

[5] J.A.N. Bruin et al., arXiv:2205.15839 (2022)