新領域
物質系専攻

山下研究室

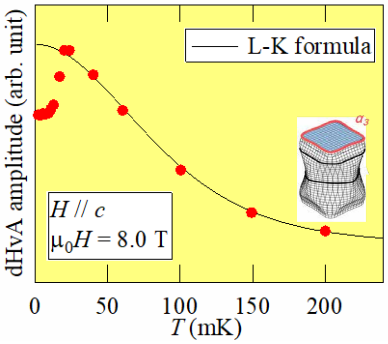
What happens when materials are cooled down close to absolute zero temperature? It sounds a boring question because everything freezes at T = 0. It is NOT true, however, because quantum fluctuations persist even at absolute zero temperature. We are interested in these quantum condensed states at low temperatures where the thermal fluctuations are negligible. Especially, we are now challenging measurements of correlated electron systems at ultralow temperatures (below 20 mK) where many interesting phenomena have remained unexplored due to technical difficulties. Further, we are studying thermal Hall effects of charge-neutral excitations (phonons and spins) in an insulator, as well as detecting multipole orders by using NMR measurements.

准教授　　山下　穣
Associate Prof. Yamashita Minoru

☐ Study of electric properties of solids at ultra-low temperatures ($T < 20$ mK)

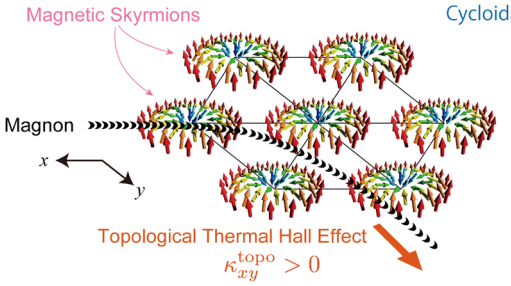
(Left) Unique cryostat capable of ultra-low (1 mK) under high-magnetic field (15 T).
(Right) Unknown phase discovered in $CeCoIn_5$ by quantum oscillation measurements at ultra-low temperatures

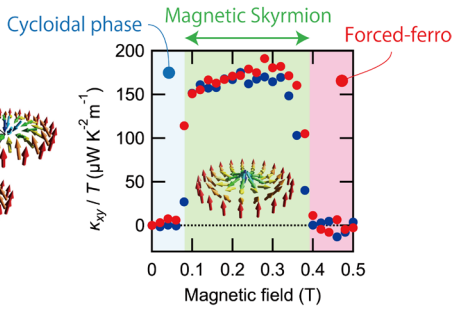
H. Shishido *et al.*, Phys. Rev. Lett. (2018)



☐ Study of topological properties of spins and phonons by thermal Hall measurements.

Topological thermal Hall effect of magnons in lattice of magnetic skyrmions



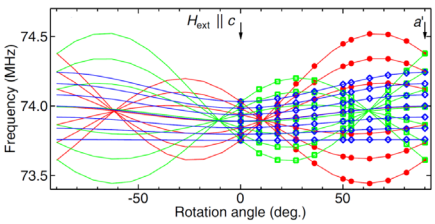


M. Akazawa et al., Phys. Rev. Research (2022).

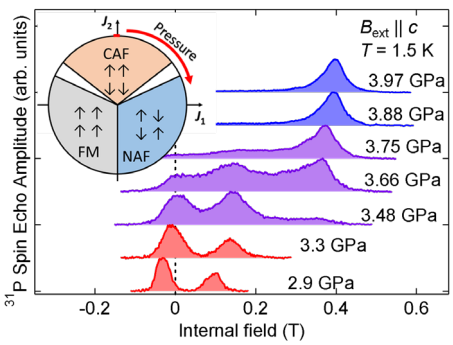
☐ Study of unconventional orders of spins and multipoles by NMR measurements

- Accurate analysis of NMR spectra detects symmetry breaking in spin and electronic systems
- Explore electron and spin fluctuations through nuclear spin relaxations

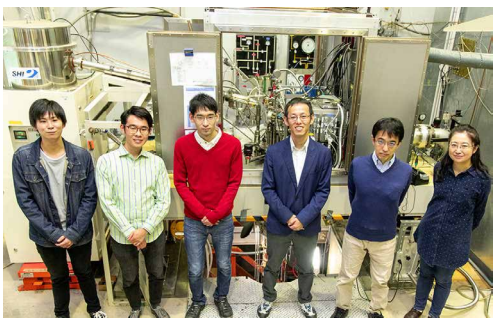
Angle-resolved NMR



Detection of pressure-induced magnetic ordered phases



H. Takeda et al., Phys. Rev. B (2021).



— We welcome your visits!! —
https://yamashita.issp.u-tokyo.ac.jp/