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High-field superconductivity in UTe_2

Due to its potentially spin-triplet-superconducting ground state, UTe_2 has triggered a wave of enthusiasm among condensed-matter researchers since the discovery of superconductivity below 1.6 K in this anisotropic heavy-fermion paramagnet. As the quality of single crystals improved, e.g., T_c was pushed to 2.1 K, some of the fog about UTe_2's mysterious properties has cleared. Nevertheless, the excitement has only become stronger, as UTe_2 exhibits signatures of multiple superconducting phases with distinct order parameters stabilized by different tuning parameters, such as pressure, magnetic field, or field orientation. Particularly, strong magnetic fields applied to UTe_2 appear to not only suppress superconductivity, as expected for a textbook superconductor, but also enhance and enable additional phases in a rare and very unconventional phase diagram. In this talk, I will providea brief overview on UTe_2's high-field properties and review recent results concerned with the field-induced superconducting phases in this special compound. In particular, I will focus on what is known so far about the reentrant superconductivity that sets in for particular field orientations at field values beyond approximately 40 T. Latest results from experiments in fields up to 70 T have certain implication to the possible origin of the extremely field-robust reentrant superconductivity in UTe_2.

[1] T. Helm et al., Nat. Commun. **15**, 37 (2024)
[2] F. Husstedt et al., Phys. Rev. B **111**, 235131 (2025)

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