## Unconventional Superconductivity in $UTe_2$ under Extreme Conditions

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$UTe_2$ is a uranium-based heavy-fermion superconductor in which superconductivity emerges from a strongly correlated electronic state. Its pronounced magnetic anisotropy and unusual response to strong magnetic fields make it a model system for exploring the interplay between magnetism and unconventional superconductivity. Both pressure and magnetic field can stabilize distinct superconducting phases, and the high-field phase diagram depends strongly on the orientation of the field relative to the crystal axes.

Specific heat, thermal expansion, and ultrasound measurements on ultraclean $UTe_2$ single crystals provide complementary views of this phase diagram. Together, they help distinguish the onset of superconductivity from transitions between superconducting phases. Particular attention is given to the similarities between the pressure–temperature and field–temperature phase diagrams, including signatures of tetracritical behavior, and to what these similarities reveal about the possible multicomponent nature of the superconducting order parameter.