Understanding Quantum Materials Under Extreme Sample Environments

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The interactions that define how spins arrange themselves in a material play a fundamental role in a wide variety of physical phenomena. Frustrated quantum magnets are systems for which the exchange interactions governing the interacting spins cannot be simultaneously satisfied, leading to a highly degenerate ground state and new states of matter such as unconventional superconductivity and quantum spin liquid in which spins are predicted to point simultaneously in different directions while they stay highly entangled even over relatively large distances. In geometrically frustrated systems, competition between neighboring spin interactions arises from the geometry of the lattice. In this talk I will discuss how hydrostatic pressure can be utilized to alter the atomic bond distances while application of magnetic field regulates the underlying spin interactions, ultimately driving the ground state across the phase diagram and leading to emergent quantum critical phenomena.