Quantum critical superconductivity in *f*-electron systems

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Since the spectacular discovery of heavy-fermion superconductivity in $CeCu_2Si_2$, reported by Steglich et al. in 1979, advanced experimental and theoretical studies on the phenomenon have continued to be at the very forefront of modern condensed matter physics. This is due to the special character of the superconducting state, which cannot be described in terms of the conventional theory, as well as due to a variety of unusual physical behavior observed in the normal state. The microscopic nature of all these anomalous phenomena usually originates from strong electronic correlations in metallic systems bearing localized magnetic moments.

In this talk, we shall briefly review the basic concepts of the physics of strongly correlated electron systems with the particular emphasis put on the formation of heavy-fermion ground states in *f*-electron materials, quantum critical phenomena and magnetically-driven superconductivity emerging at the verge of magnetic instability. An overview of the significant progress made in the area will include a short presentation of some results recently obtained by our research team. Eventually, an attempt will be made to identify a few most challenging open questions in the relevant field.