Dottorato di Ricerca in Fisica dell'Università degli Studi di Messina
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Electron correlations in metals: Dynamical mean-field theory

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Electrons in metals feel only a screened, short-range Coulomb repulsion. In most of the transition metals, lanthanides and actinides electron correlations are not negligible. To describe the correlation effects correctly one needs a reliable description of strong electron correlations. Gross features of weak excitations of the ground state of interacting fermions are described by Fermi-liquid theory. To assess collective phenomena with quantum coherence in heavy metals, it is necessary to go beyond the framework of Fermi liquid. The way to go systematically beyond Fermi-liquid theory is offered by the so-called Dynamical Mean-Field Theory. We review in this talk the underlying ideas of the dynamical mean-field theory originating in the single-impurity Anderson model and the Kondo effect. We further discuss various aspects of presently the most advanced theory of strongly correlated electrons with examples of its application in model and realistic calculations of electronic properties of metals.