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Understanding Strongly Correlated Materials thru Theory Algorithms and High Performance Computers

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A long standing challenge in condensed matter physics is the prediction of physical properties of materials starting from first principles. In the past two decades, substantial advances have taken place in this area. The combination of modern implementations of electronic structure methods in conjunction with Dynamical Mean Field Theory (DMFT), in combination with advanced impurity solvers, modern computer codes and massively parallel computers, are giving new system specific insights into the properties of strongly correlated electron systems enable the calculations of experimentally measurable correlation functions. The predictions of this "theoretical spectroscopy" can be directly compared with experimental results. In this talk I will briefly outline the state of the art of the methodology, and illustrate it with an example the origin of the solid state anomalies of elemental Plutonium.