VIENNA COMPUTATIONAL MATERIALS LABORATORY
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QUANTUM MATTER WITH STRONG CORRELATIONS
- FROM HOT SUPERCONDUCTORS TO COLD ATOMS -

A TALK BY PROF. DR. ANTOINE GEORGES,
CENTRE DE PHYSIQUE THÉORIQUE (CPHT), COLLÉGE DE FRANCE & ÉCOLE POLYTECHNIQUE IN PALAISEAU CEDEX, FRANCE

DATE / TIME	24.01.2012, 5:15 p.m. (CET)
LOCATION	Lecture Hall P2, Graz University of Technology, Petersgasse 16, A-8010 Graz, AUSTRIA

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From copper-oxide superconductors to rare-earth compounds, materials with strong electronic correlations have focused enormous attention over the last two decades. Solid-state chemistry, new elaboration techniques and improved experimental probes are constantly providing us with examples of novel materials with surprising electronic properties, the latest example being the recent discovery of iron-based high-temperature superconductors.

In this colloquium, I will emphasize that the classic paradigm of solid-state physics, in which electrons form a gas of wave-like quasiparticles, must be seriously revised for strongly correlated materials. Instead, a description accounting for both atomic-like excitations in real-space and quasiparticle excitations in momentum space is requested. I will review how Dynamical Mean-Field Theory -an approach that has led to significant advances in our understanding of strongly correlated materials- fulfills this goal.

New frontiers are also opening up, which bring together condensed-matter physics and quantum optics. `Artificial materials' made of ultra-cold atoms trapped by laser beams can be engineered with a remarkable level of controllability, and allow for the study of strong-correlation physics in previously unexplored regimes.