Material Design and Strongly Correlated Electron Systems

INC COLLOQUIUM – OFFICIAL ANNOUNCEMENT

Title: Material Design and Strongly Correlated Electron Systems
When: Friday, 16th of January, 2015 at 12h30
Where: Sala de conferencias módulo 00, Facultad de Ciencias.
Speaker: Gabriel Kotliar, Rutgers University
ABSTRACT:

Our understanding of simple solids, is firmly grounded on the Fermi liquid concept and powerful computational techniques built around the density functional theory. These ideas form the basis of our “standard model” of solid state physics and have provided us with an accurate description of many materials of great technological significance.
Correlated electron systems are materials for which the the standard model of solid state physics fails dramatically. The best known example being the copper oxide high temperature superconductors.
Correlated electron materials continue to be discovered accidentally and surprise us with their exceptional physical properties and their potential for new applications. The most recent example is provided by the iron arsenide based high temperature superconductors.
From a theoretical perspective describing strongly correlated electron systems pose one of the most difficult non-perturbative challenges in physics. In this colloquium I will give an elementary introduction to the field of strongly correlated electron materials and Dynamical Mean Field Theory (DMFT) a non perturbative method which provides a zeroth order picture of the strong correlation phenomena in close analogy with the Weiss mean field theory in statistical mechanics. Applications materials containing f and d electrons will be presented to show how the anomalous properties of correlated

materials emerge from their atomic constituents.
I will conclude with an outlook of the challenges ahead and the perspectives for a rational material design.