Institut de Nanociència i Nanotecnologia

UNIVERSITAT DE BARCELONA

Programmable Self-Assembly of Nanocrystals

By Alex Travesset, Iowa State University

27th June at 12h- Sala Eduard Fontseré (Faculty of Physics)

Materials whose fundamental units are nanocrystals (NC)s, instead of atoms or molecules, are gradually emerging as major candidates to solve many of the technological challenges of our century. Those materials display unique structural, dynamical and thermodynamical properties, often reflecting deep underlying geometric, packing and topological constraints. In this talk, I will discuss the rational design of NC materials by programmable self-assembly through DNA, by electrostatic phase separation of neutral polymers, by attachment of irreversible dithiol linkers and also, through hydrocarbon and polystyrene capping ligands via solvent evaporation. I will present the Orbifold Topological Model (OTM), which successfully describes the structure of crystal or quasicrystal arrangements of NCs (superlattices) by considering capping ligands as Skyrmion textures, which determine the bonding very much like atomic orbitals in lattices of simple atoms. I will show that the OTM describes "atomic orbitals" as consisting of vortices, which enable the generation of a spontaneous valence and reveal the universal tendency of these systems towards icosahedral order. I will elaborate on the success of the OTM in describing all existing experimental structural data on single component and binary superlattices.

Alex Travesset got his PhD from the Universitat de Barcelona in 1997. After Postdoc positions in Syracuse University and University of Illinois at Urbana Champaign, he joined the faculty at the Department of Physics and Astronomy at Iowa State University, where he is now full professor. He also holds an appointment as an associated scientist at the Ames lab.

For further details on this lecture, contact: carles.calero@ub.edu