CORE-CM SEMINAR
Michigan State University

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Colloidal semiconductor nanocrystals : From single objects to artificial solids

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Semiconductor nanocrystals prepared by colloidal chemistry have been studied for more than three decades but it is only now that they are employed in mass-market commercial applications. Nowadays, these nano-objects can be fabricated with an excellent control of their composition, size and shape in such manner that their electronic structure and their optical properties can be accurately tuned. Semiconductor nanocrystals can be sometimes considered as artificial atoms for reasons which will be discussed. In this talk, I will present recent advances in the field that potentially open new perspectives of application. I will show that the artificial atoms can be self-assembled to form new types of two-dimensional crystals in which the electronic structure results from the effect of the periodic scattering of the electrons induced by the nanogeometry. Recent progress in colloidal chemistry enables the fabrication of materials in which each nanocrystal can be considered as a LEGO brick®. Moreover this concept of LEGO® can be extended to the calculation of the electronic band structure of the superlattices. By combining the original band structure of the bulk semiconductor and the effects of the nano-structuring, we show that these new materials are characterized by exotic band structures including Dirac cones, non-trivial flat band bands, and topological bands.

References

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Thursday, December 6, 2018
12:00 NOON
Room 1400 – Biomedical & Physical Sciences
Professor Ben Levine - Host