International Doctoral Program in Science Fellowship

ADVANCED OPTICAL INVESTIGATIONS OF HALIDE PEROVSKITES AND THEIR CHEMICAL TRANSFORMATIONS

Background and motivation

The project will tackle two novel aspects. The first centers on synthesizing chemically complex hybrid perovskite nanostructures and thin films using solution chemistries. This includes mixed cation and mixed anion hybrid perovskite quantum dots, nanowires and nanoplatelets. Hybrid perovskites are important materials for the creation of next generation solar cells. Recent studies have shown that solution-processed hybrid perovskite solar cells can exhibit power conversion efficiencies exceeding 20%. There is similar interest in hybrid perovskite nanostructures where corresponding quantum dot solar cells have achieved power conversion efficiencies exceeding 13%. Despite widespread application of these materials for use in solar energy conversion, much is not understood about the basic photophysics of these materials. Consequently, the second novel aspect of the proposed work will be to conduct detailed spatially-resolved optical measurements of hybrid perovskite photophysics. For mixed cation and anion materials this includes efforts to understand light-induced cation/anion phase segregation. For analogous nanostructures such as nanowires this entails measurements of single wire excited state progressions and absorption/emission Stokes shifts. Of note is that a debate exists regarding existence of a Stokes shift as it is not immediately predicted by certain theoretical models of the perovskite electronic structure.

The main goals of the project are:

- Accessing the photophysics of halide perovskites
- Optical properties of single nano-objects

Profile

- Diploma: Master's degree or comparable qualification in Physics, Materials Science, Chemistry or adjacent fields. The title must be obtained before OCTOBER 31ST 2018.
- A strong interest for multidisciplinary research is required.
- A solid background in physics, materials science or materials chemistry is required.
- Experience in optical microscopy and solution phase chemical synthesis will be considered as an advantage.
- Good knowledge of the English language, both spoken and written, is essential.
- Strong commitment, ability to work in a team, and eager for international mobility is desired.

Opportunities

- Perform experimental research in an interdisciplinary research environment and actively participate to the international collaboration between research groups in Italy and the United State, with the aim of achieving a doctorate diploma under the joint supervision by the Italian Institute of Technology (IIT), University of Notre Dame and Università Cattolica del Sacro Cuore. The overall tutoring activity will be conducted by staff members at the Italian Institute of Technology, University of Notre Dame and Università Cattolica del Sacro Cuore .

Supervisors

Prof. Liberato Manna, Italian Institute of Technology (Italy)
Prof. Masaru Kuno, University of Notre Dame (U.S.A)
Dr. Francesco Banfi, Univesrità Cattolica del Sacro Cuore (Italy)

Info

Applications will appear HERE
Pre-applications available at http://scuoledidottorato.unicatt.it/phdschools/science-home
Application deadline: September 28th, 2018
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