Establishing microscopic photophysics in hybrid perovskite solar cells

**Background and motivation**
The world-increasing demand of clean energy is pushing towards the production of low-cost and efficient solar cells. To overcome silicon-based technology, new materials have emerged such as hybrid perovskites, a mixed organic-inorganic compound. Hybrid perovskites such as MAPbI$_3$ (MA=CH$_3$NH$_3^+$) and mixed halide perovskites such as MAPb(I$_{1-x}$Cl$_x$)$_3$ and MAPb(I$_{1-x}$Br$_x$)$_3$ represent intriguing materials since in just 5 years the power conversion efficiencies matched those of silicon. Despite this, there still exists a dearth of microscopic insight into solar cell performance beyond simple device-level metrics. Major issues are: 1) to unveil the microscopic photophysics of the material, linking device performance to local electronic disorder originating from cation/anion phase segregation; 2) the long-term stability of hybrid perovskites, that are susceptible to dynamic transformations linked to ion migration, involving both cations and anions.

We are therefore developing spatially-resolved optical techniques that will enable us to study the microscopic photophysics of hybrid perovskite materials. The project we are seeking a student for centers on linking device performance to local electronic disorder originating from cation/anion phase segregation. This will involve direct optical measurements of perovskite thin film as well as solar cell absorption and emission. It will also entail use of a superresolution infrared absorption technique called photothermal heterodyne imaging to directly image for the first time cation migration under applied bias.

**Profile**
- Master’s degree or similar qualification in Physics, Materials Science, Chemistry or adjacent fields.
- A solid background in physics, materials science or materials chemistry is required.
- Experience in optics, microscopes and home-built instrumentation will be considered as an advantage. Programming skills, for example in Python, are also desired.
- 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**
- Experimental research participating to the international collaboration between research groups USA and Italy. **Double degree opportunity. The position is available immediately. Student stipend at the University of Notre Dame is currently $30,448 before tax. Health insurance is provided at no cost.**

**Supervisors**
Prof. Masaru Kuno and Prof. Prashant Kamat, University of Notre Dame (U.S.A)
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