

An Indian-Australian research partnership

**Project Title:** **Influence of Packing of Organic Semiconductor on Photoinduced Charge Generation and Transport Properties**

**Project Number** **IMURA0353**

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## Research Academy Themes:

**Highlight which of the Academy's Theme(s) this project will address?**

*(Feel free to nominate more than one. For more information, see [www.iitbmonash.org](http://www.iitbmonash.org))*

1. Advanced computational engineering, simulation and manufacture
2. Infrastructure Engineering
3. **Clean Energy**
4. Water
5. **Nanotechnology**
6. Biotechnology and Stem Cell Research

## The research problem

*Conventional photovoltaic technology will certainly contribute this century, but to generate a significant fraction of our global power from solar energy, a radically new disruptive technology is required. Research primarily focused on developing the physical understanding of low cost photovoltaic technologies is required. Solution processible organic semiconductors, with power conversion efficiency as high as ~ 12 %, have emerged over the last decade as promising alternatives to expensive silicon based technologies. Due to their large linear and nonlinear absorption cross-sections, and also to their semiconductor and mechanical properties, organics are well-suited to provide potentially low-cost, large area and flexible solar cells for a wide variety of niche applications. Under this project, we shall like to investigate the influence of packing of organic semiconductor molecules in terms of their structures, morphology and intermixing on charge generation upon optical excitation and transport physics of photoinduced*

*charge carriers.*

### **Project aims**

*Study of Influence of Packing of Organic Semiconductor on Photoinduced Charge Generation and Transport Properties.*

### **Expected outcomes**

*Highlight the expected outcomes of the project*

Monash group is expert in characterizing soft thin film to understand morphology and packing of macromolecules, which is very important in fabricating high performance devices.

Indian partner is expert in characterizing various optoelectronic devices and photophysics of these materials.

In combination, we expect to have technologically important cheap solar cells and lighting source.

### **How will the project address the Goals of the above Themes?**

*Describe how the project will address the goals of one or more of the 6 Themes listed above.*

Nanostructured thin films are required to generate efficient photoinduced charge generation with an optimum transport network for positive and negative polarons to make efficient photovoltaics from these excitonic semiconductors. However, to achieve this nanostructured film, there is a need of good control over morphology and packing of polymer chains at nanometers level domain.

Clean energy: Outcome is going to give low cost photovoltaic technology and energy efficient lighting from molecular semiconductor films.

### **Capabilities and Degrees Required**

*List the ideal set of capabilities that a student should have for this project. Feel free to be as specific or as general as you like. These capabilities will be input into the online application form and students who opt for this project will be required to show that they can demonstrate these capabilities.*

Ideal candidate should have

1. Sound knowledge of Physics
2. Photonics as major
3. Good in handling Labview and Matlab towards computer program
4. Either electrical engineer/ engineering physics at undergrad level or masters in Physics