

MONDAY

# COLLOQUIUM

## From Molecular Design to Device Function: Electronic Doping and Charge Transport in Soft Semiconductors

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06 Jul 2026 (Monday) | 16:00 Hrs (Tea / Coffee 15:45 Hrs) | Venue: TIFRH Auditorium

The performance of soft semiconductors is fundamentally governed by the ability to control charge generation, transport, and stability through molecular design. I will highlight recent advances in electronic doping, charge transport, and materials synthesis that establish new design principles for next-generation organic and hybrid semiconductor devices. We have developed a series of molecular doping strategies that achieve near-unity free-carrier generation in organic semiconductors through clean, additive-free, and modular approaches. These advances establish a unifying framework that enables simultaneous optimisation of conductivity, operational stability, and device compatibility. Complementary studies reveal how molecular structure and ionic interactions govern charge delocalization and transport, providing fundamental insights for the rational design of doped soft semiconductors.

Beyond organic semiconductors, the talk will discuss insights into charge dynamics in low-dimensional materials and scalable synthesis strategies for semiconductor fabrication. These include an electrosynthetic route for the aqueous fabrication of highly crystalline perovskite films and a one-pot strategy for producing highly conductive n-type polymers through in situ doping during polymerization. Collectively, these advances demonstrate how molecular-level understanding can be translated into scalable materials and high-performance optoelectronic devices, bridging the gap between fundamental science and emerging semiconductor technologies.