



Indian Institute of Science Education and Research
Thiruvananthapuram

भारतीय विज्ञान शिक्षा एवं अनुसंधान संस्थान तिरुवनंतपुरम

Physics Department Colloquium

*Light-driven microdrones:
From fundamentals to applications*



Speaker

Prof. Bert Hecht

University of Würzburg

Tuesday, 11 November 2025

04:00 PM

PSB Seminar Hall, IISER Thiruvananthapuram

About the Speaker



Bert Hecht is an expert in plasmonics and nano-optics. He received his PhD in 1996 from the University of Basel, Switzerland in collaboration with IBM Rüschlikon Research Lab, where he worked under supervision of Dieter Pohl on near-field optical microscopy. He then spent a postdoc at ETH Zurich with Urs Wild working on microscopy and spectroscopy of single molecules. After that he was awarded a research professorship of the Swiss national science foundation, which he spent at the University of Basel. In 2006 he joined the University of Würzburg, Germany, first as associate and later as full professor of experimental physics.

The Hecht group is currently investigating the physics and applications of strong coupling at of plasmonic nanoresonators to single emitters at ambient conditions, electrically-driven and -actuated nano-optical hybrid systems, as well as optically driven microdrones and many further exciting topics.

Abstract

We recently have introduced light-driven microdrones – objects that can be controlled by unfocused laser light in aqueous environments in all six degrees of freedom in 2D [1]. In the colloquium we will introduce the concept of light-driven nanomotors and how they can be used to build microdrones. We will then proceed to discuss potential applications. An important step is to supplement the microdrones with a resonant gold cross antenna which acts as a plasmonic tweezer element [2]. This addresses the critical challenge of nanometer-precise transport and delivery of cargo, particularly nano-sized particles, in liquid media. We demonstrate intricate interactive manipulation sequences, including trapping, transport, release, and re-trapping of nanodiamond particles, underscoring the transformative potential of our approach for applications ranging from transport of nanoscale cargo and drug delivery to localized quantum sensing.

1. Light-driven microdrones,

Xiaofei Wu, Raphael Ehehalt, Gary Razinskas, Thorsten Feichtner, Jin Qin & Bert Hecht,
Nature Nanotechnology 17, 477-484 (2022), <https://doi.org/10.1038/s41565-022-01099-z>

2. Light-driven plasmonic microrobot for nanoparticle manipulation,

Jin Qin, Xiaofei Wu, Anke Krueger & Bert Hecht,
Nat Commun 16, 2570 (2025), <https://doi.org/10.1038/s41467-025-57871-x>