ICFO

SEMINAR: Vibronic coupling-driven ultrafast dynamics in functional materials for solar energy conversion

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11:00 to 12:00
Elements Room

Ultrafast non-equilibrium dynamics following photoexcitation of functional materials arise from a complex interplay between electronic and vibrational motion. A detailed understanding of how vibronic couplings influence the initial energy redistribution, relaxation and localization of excitations is crucial not only for interpreting ultrafast phenomena, but also for controlling nanoscale energy transport and for guiding the rational design of functional materials for energy conversion and quantum technologies. Most of the mechanisms underlying these processes occur on ultrafast, few 100s fs timescales, demanding experimental methods that combine high time resolution and the ability to resolve couplings. Quadrupolar acceptor-donor-acceptor (A-D-A) molecules constitute an important class of organic functional materials, promising for applications in photovoltaics, light emission, and nonlinear optics. Beyond their technological relevance, they also provide a versatile material platform for investigating ultrafast nonadiabatic dynamics mediated by vibronic couplings. In this talk, I will present an overview of selected recent results obtained using ultrafast two-dimensional electronic spectroscopy to get detailed insight into vibration-mediated excited state dynamics in A-D-A molecules undergoing excited state symmetry breaking, and into ultrafast wavepacket dynamics through conical intersections in their aggregates [1-3]

[1] Nature Nanotechnol. 16, 63-68 (2021); [2] Nature Chem. 17, 1742 (2025); [3] J. Phys. Chem. Lett. 7, 976-983 (2026)

Hosted by: Prof. Dr. Jens Biegert