

MONDAY

COLLOQUIUM

Optical Instabilities of Perovskite Crystals: Blink-in-Sync or Not to?

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

While ubiquitous for single fluorescent molecules and quantum-confined luminescent nanocrystals (such as quantum-dots), stochastic optical instability in terms of discrete photoluminescence (PL) intermittency (*aka* blinking or flickering) has been seldom reported for objects which extend beyond nanoscale dimensions. Upon investigation of single organo-metal halide perovskite (OHP) crystals, we discovered a surprising phenomenon where entire microns-sized $(\text{CH}_3\text{NH}_3)\text{PbBr}_3$ disks/rods undergo multi-level abrupt flickering on top of a base emission, somewhat reminiscent of single quantum-confined nanocrystals. Intriguingly, such photoinduced optical instability was found to be spatially-synchronous across each micro-crystal which implies extremely long-range ($>\mu\text{m}$) communication amongst carriers photogenerated at distal locations. Our recent measurements on single micro-rods/wires reveal that spatial correlations in blinking events often vary over both space and time – being either synchronous within certain spatial or temporal windows, while being uncorrelated in other zones/times – which makes it challenging to interpret their origins. We propose a phenomenological model which involves the activation-deactivation of very few, highly efficient metastable traps, coupled with long-range correlated carrier migration leading to abrupt quenching of PL in certain locations. This presentation will provide plausible mechanisms for spatiotemporally (in)homogeneous optical instabilities in OHPs, which may be relevant for their usage as active layers in solar photovoltaic and light emissive devices.