MONDAY

COLLOQUIUM

Photoactivating C-H bonds in Water: A Temporal Framework

Jyotishman Dasgupta (TIFR, Mumbai)

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

Enzymes are proteins that catalyze non-spontaneous organic reactions in physiological conditions. Remarkably the water-insoluble organic substrates are usually encapsulated in hydrophobic protein cavities, which constitute reaction hotspots in enzymes. Over the past 10 years, we have devised a new catalytic photoredox paradigm using water-soluble cationic nanocages that mimic the enzyme cavity while providing a modular host-guest photoactivation strategy. Through the potent combination of light activation and substrate pre-organization in water, we demonstrate facile yet selective aerobic oxidation of hydrocarbon C-H bonds under ambient conditions using temporally sequential proton-coupled electron transfer (PCET). Additionally, sp2 C-H functionalization and C-C bond formation were demonstrated recently along with usage of aqueous reactivity by an novel cage-trapped Fe(IV)-superoxo complex. Using time-resolved Raman spectroscopy, we show that the water cluster around and inside the nanocage plays a crucial role in driving the PCET chemistry leading to C-H activation. The success of our designed artificial photoenzyme hints at the crucial role of electric fields in driving reactions within nanospaces.

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