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FOR BASIC SCIENCES
Block JD, Sector III, Salt Lake, Kolkata 700 106

DEPARTMENTAL SEMINAR

Chemical, Biological & Macro-Molecular Sciences

07th December'2021 **4.00 PM** **ONLINE**

SPEAKER

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TITLE OF THE TALK

Excited state phenomena in fluorogenic molecules and semiconductor nanocrystals

ABSTRACT

Fluorogenic molecules and semiconductor nanocrystals constitute two different kinds of systems that are interesting from the points of view of photophysics and applications thereof. Schiff bases are a widely studied class of fluorogenic compounds. They are weakly fluorescent, because of efficient nonradiative pathways operative in them [1], by virtue of their flexible structure. Rigidification of the molecules by complexation with certain metal ions leads to the increase in fluorescence quantum yield and lifetime by orders of magnitude, provided π-stacking among the ligands is avoided. Interestingly, even without complexation, enhancement in these parameters is obtained, albeit to a smaller extent, by deprotonation of the phenolic hydroxyl group [2,3]. This is likely to be due to delocalization of the negative charge over the molecule, leading to an increased degree of rigidity. On a different note, photoluminescence (PL) of tetrapod shaped CdSe nanocrystals [4-7] and spherical CdS nanocrystals [8,9] have been found to be governed by intricate exciton dynamics. Dual emissive oleic acid-capped CdSe nanotetrapods exhibit poor PL quantum yield (PLQY) [4]. The band edge emission exhibits trapping times of 1 ps and 8 ps, while the red shifted, broad trap emission has a lifetime in tens of ns. Upon suppression of the trap emission by modification of the synthesis protocol, the 1 ps trapping time disappears, while the 8 ps one persists [5]. Hence, they are assigned to processes that lead to the population of radiative and nonradiative trap states, respectively. In the quest for strong PL, nanotetrapods have been doped with Cu(I) and this has led to a red shifted charge transfer (CT) PL with significantly larger PLQY of 38% and lifetime of 500 ns [6]. The trigger for this strong PL is provided by ultrafast hole capture by Cu(I) and consequent decrease in overlap between electron and hole wavefunctions. PL from water-soluble nanotetrapods, prepared by ligand exchange, remains elusive till date [7]. However, Polyethelenimine (PEI)-capped spherical CdS nanocrystals, prepared in aqueous medium, have been found to be strongly photoluminescent [8]. The interplay of multiexcitonic processes and trap emission in these nanocrystals has been worked out carefully. The mechanism of selective turn-off PL sensing of Pb2+ by these nanocrystals, involving ultrafast electron and hole trapping, has been explored [9].

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