S N BOSE NATIONAL CENTRE
FOR BASIC SCIENCES
Block JD, Sector III, Salt Lake, Kolkata 700 106

DEPARTMENTAL SEMINAR

Condensed Matter and Materials Physics

3rd April,2024 **4.00 PM** **ONLINE/ FERMION**

SPEAKER
Dr. Avijit Saha
Postdoctoral Research Fellow.
Technische Universität Dresden

TITLE OF THE TALK

PB- AND CD-FREE QUANTUM DOTS: SYNTHESIS, PROPERTIES AND APPLICATIONS IN OPTOELECTONIC DEVICES

ABSTRACT

The pursuit of highly efficient and economically viable optoelectronic devices has witnessed substantial growth over recent decades, driven mainly by advancements in novel materials that complement or supplant traditional counterparts. Semiconductor quantum dots (QDs) have emerged as focal points within this arena, owing to their exceptional optoelectronic properties such as tunable bandgap, large absorption coefficient, enhanced photoluminescence quantum yield, and superior optical resilience. Unfortunately, despite the synthesis of a myriad of semiconductor QDs for visible region applications, the availability of ultraviolet (UV) and near-infrared (NIR) emitting QDs remains scarce. Moreover, such NCs mostly rely on heavy metals such as cadmium (Cd) and lead (Pb), which are highly toxic, therefore restricted for widespread use in electronics and biomedical applications, and banned by the European RoHS (Restriction of Hazardous Substances) directive. This emphasizes the critical need to develop more efficient, eco-friendly QDs to compete with and replace conventional Cd/Pb-based QDs in various applications.

In my presentation, I shall delve into the development of several Cd/Pb-free, new and modified efficient QDs in both the UV and NIR spectrums, highlighting their intriguing photophysical properties. I will elucidate our synthetic methodologies, enabling precise modulation of intermediate defect states and facilitating targeted monitoring of specific optical transitions within the QDs. Furthermore, I will demonstrate the application of these QDs as efficient photodetectors, emphasizing their practical utility. Additionally, I'll showcase a QD-based stacking device designed to effortlessly discriminate UV light across various UV bands. This discrimination can be achieved using a standard CMOS image sensor (camera) or observed by the naked eye, eliminating the need for complex optics. The versatility and efficiency of these QDs open up new possibilities for advanced optoelectronic applications.

HOST FACULTY

Dr. Nitesh Kumar, Assistant Professor

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