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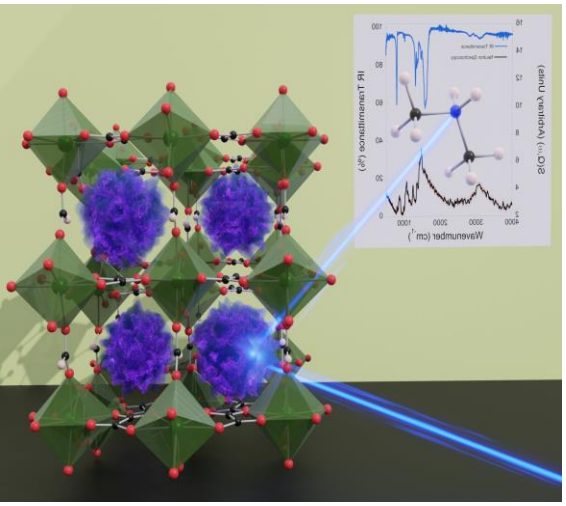
DEPARTMENT OF PHYSICS

SEMINAR SERIES: 2024/2025

Fabrication of Hybrid-Perovskite via Solution Processing Method for Solar Cell and Bio-Medical Application



Presenter: Mr. Matheu Mahabir

Date: 26th May, 2025

Time: 11:00 am

Venue: DCIT Conference Room

Title: Fabrication of Hybrid-Perovskite via Solution Processing Method for Solar Cell and Bio-Medical Application.

ABSTRACT

A piece of rock collected in the Ural Mountains scientists on an expedition suspected the rock contained strange crystals with strange structure not noted in the archives. The crystals exhibited cubic structure and the chemical composition comprised of calcium and titanium oxide. The very first chemical composition was $CaTiO_3$. Perovskite is no longer associated with the mineral defined by $CaTiO_3$ because many synthetic compounds crystallize in the same type of structure. Perovskite is now defined by unique structure type. The conventional chemical formula for perovskite is ABX_3 or AMX_3 in which A and (B or M) are cations and X is an anion.

China being a world leader in perovskite publications and pilot-scale production. Heavily investing in commercialization. United States & Europe invest in fundamental research, material stability, and tandem solar cell integration (e.g., with silicon).

Key research areas include: Efficiency as single-junction perovskite solar cells now exceed 26%, rivalling silicon, stability being one of the biggest hurdles; efforts focus on passivation, encapsulation, and compositional tuning though stability is not an issue for perovskite in space application and scalability techniques like slot-die coating and blade coating are being tested for industrial-scale production.

In this project spin coating is the primary mode of fabrication because it offers complete control of precursor stoichiometry as opposed to PVD and CVD methods. It is a simple technique requiring no in-depth expertise whilst still producing PCE comparable to that of other techniques. Spin coating can be done on bench top with only one machine and is ideal for research and microelectronic thinfilm and because there is no need for vacuum the cost is quite minimal.

The purpose of this study is to investigate the capability, applicability and stability of Hybrid Perovskite with TiO_2 and spiro-OMeTAD transport layers in solar photovoltaic and gamma detection. Focus of the solar cell portion of the project is to produce a solar cell with a high enough PCE such that it can rival conventional silicon with the addition of Cl ions. The x-ray detector is intended to exhibit much higher sensitivity as compared to commonly used detectors under diagnostic x-ray irradiation from Co60 source.

There is no end to the benefits of hybrid perovskite research since their usage expands over important industries such as semi-conductors and detectors. Moreover, it uses little to no precious metals like diamonds and metals and it has low-cost manufacturing capabilities. Any industry that makes use of micro and nano electronics is an avenue for perovskite development. Because of its band-gap tunability it is applicable to areas outside of solar cell and x-ray detectors such as lasers, LEDs and gas separation and sensing and applications in space as there is no heat or light to degrade perovskite.