Nirat RAY

Home Country
India

Degree
PhD in Physics

Expertise
Materials Characterization, Electronic Testing

Research Focus
Electron Transport in Nanocrystal Arrays

Host University
Massachusetts Institute of Technology, United States

Fellowship Awarded
2012

Nirat Ray was born in New Delhi, India, and lived there for most of her childhood.

Nirat gained a BSc in Physics from Hans Raj College, University of Delhi, where she was the recipient of the University's Science Meritorious Award for four consecutive years. In 2006, she was selected as a summer research student at the Jawaharlal Nehru Centre for Advanced Scientific Research. She was awarded the Rajeev Gandhi Science Talent Award for Physical Sciences, and spent a year working in the Center as a Junior Research Assistant. She then gained an MSc in Physics from the Indian Institute of Technology, Delhi. She started her PhD in 2009, supported by a Fulbright Science and Technology Award.

Her PhD research investigates electron transport in arrays of quantum dots (QDs), resulting from quantum confinement in all three spatial dimensions. Colloidal quantum dots (CQDs), fabricated using a solution-based synthesis, have found widespread use in fields such as biomedicine, photovoltaics, and electronics. They also hold promise for more efficient solar cells. As they behave almost like oversized atoms, they are often called artificial atoms, and quantum dot arrays can be used to study fundamental processes of solids.

Nirat and her co-researchers have developed a novel technique to nano-pattern ordered arrays of nanocrystals and position them with 50 nm precision. They have also developed a method for time-resolved measurement of charge with a nanoscale sensor, which is sensitive to single electron fluctuations, and can probe transport in regimes where the current is immeasurable. Their aim is to integrate the charge sensors with the nano-patterned arrays and understand the charge dynamics in these arrays. The results could accelerate the application of new materials in electronic devices.

After receiving her PhD, Nirat intends to return to India as a faculty member in a leading research institute.