Letter of Motivation

ALOK RAJ rajalok581@gmail.com

I want to pursue a research career in Experimental Condensed Matter Physics and I aspire to work as a scientist in Industrial Research and Development afterwards. My research interest lies in Solid State Devices, Functional Materials, Microelectronics, Optoelectronics, Semiconductor Physics, Device Fabrication and Characterization.

After 5 years of formal education in Mathematics and Physics, I want to do much more focused research. My motivation to pursue research in the field of Quantum Materials and devices is the result of my academic endeavors and my Master's Thesis work described in following paragraphs.

My post-graduate degree of Master of Science in the field of Physics, and research training based on material deposition, characterization and device fabrication has provided a thorough exposure to the various specialties available in material science, thus stimulating my interest in advanced research. We need these Halide Perovskite Nanostructures to devise efficient and functional Optoelectronic devices. I have equipped myself with participation in various conferences throughout my graduation and research career. Along with this, I have done research internships which made me confident to pursue a research career in this field.

I also worked as a Project Assistant in Dr. Anshu Pandey's Lab at the SSCU Department, Indian Institute of Science Bangalore. I was working on thin film deposition techniques such as sputtering and thermal evaporation. Along with this I did several Electrical Characterization of the devices fabricated, at low temperature, room temperature and high temperature conditions. I was recently working on "Doping of Perovskite Nanostructures and its Optoelectronic Applications" during my Master's Research work at IIT Guwahati under the supervision of Prof. P. K. Giri. During my research work, I fabricated Metal Halide Perovskite Nanostructures and then characterized them with various techniques. I also doped Metal Halide Perovskites with Rare earth ions to increase its various properties and stability. Then we utilized the novel properties of the as-fabricated material in Optoelectronic device fabrication. We also looked upon the unresolved issues in advancement of realizing Perovskite Nanostructures for efficient functional Optoelectronic devices. My approach has always been interdisciplinary and I took courses ranging from core Physics to Quantum technologies apart from my specialization. The main Graduate level courses which were pivotal in my research interest are Functional Materials and devices, Nanotechnology energy systems, Measurement and Characterization Techniques, Thin Film Phenomena, Nanostructure Materials and Semiconductor Optoelectronics.

I am interested in the "Design and Fabrication of the 2D Heterostructures towards Coherent in-plane Quantum Light Emission and Optoelectronic Devices" project specifically because it offers a good combination of work on advanced functional Nanomaterials, Nanostructures,

devices, Advanced Characterization techniques and Spectroscopy for solid state physics and Quantum Photonic devices. We will technologically optimize Two-Dimensional (2D) Transition Metal Dichalcogenide (TMD) Heterostructures for use in Optoelectronic and Quantum Photonic Devices. Photonic Integrated Circuitory is a field that is undergoing great expansion and promises solutions for devices beyond CMOS technology. It is highly explored field both post von-Neumann and Quantum Computation and Sensing. Photonic Devices can replace the electronic ones having high operating speed and low energy losses as potential light sources. Quantum materials that allow charge confinement are hailed as energy efficient, and require defect free heterostructures which 2D materials can readily achieve. Two Dimensional materials can confine both charge carriers and excitons at well defined regions and can produce Distributed Bragg Reflectors(DBR) for Optoelectronic Devices. These ultra clean materials and edge-epitaxy lateral heterostructures are synthesized and characterizated for the fabrication of integrable coherent light sources which can produce in plain and directional light. I believe that my previous experience with material synthesis, device fabrication, cryogenic measurements of devices and characterization of samples make me a suitable fit for this position.

I believe that the breadth of experimental techniques that the project offers, spanning from materials growth and characterization, to device creation and their measurement, is a great opportunity for me to expand my knowledge into the fields that are of interest to me. I believe I will benefit strongly from the interaction with the two academics that form the supervisory team of this project, and other academics beyond. The research carried out in the Material Science Centre, IIT Kharagpur and Photon Science Institute, University of Manchester appears to be very diverse and in a dynamic, international environment. Together with the wider University facilities that are available for research in advanced nanomaterials, devices and spectroscopy, I believe that this is an environment that will help me to grow as individual. I am aware of the challenges and obstacles of a PhD and I believe that my research background, efficient skills and professional experience will help me flourish in this environment at both the eminent institutions.

My final goal is to take my research beyond the lab and build quality devices, which can help the general public, or help scientists to find simpler solutions to societal challenges of the future. For all the reasons above, I would like to apply for this PhD position under this project. I am curious to learn more and get hands-on experience, and I believe that giving me this opportunity, I can contribute significantly towards the goals of this research topic. Therefore, I would like you to consider me for this PhD as this will be an ideal opportunity to cater to my research interests and ambitions.