



PhD Project

Project Details	
Project Title	Superconducting Single Photon Detectors for Quantum Communication
Project Summary	<p>Secure communication is very fast becoming the key requirement of National security. Quantum nature of light allows for well-designed communication schemes by letting the legitimate participants know when being eavesdropped. Tremendous advances have been made by several countries in demonstrating long distance surface and surface-space quantum communications. A key component of secure quantum communication and key sharing protocols is an efficient, fast and sensitive single photon detector. Here, we propose to design and develop ultrafast superconducting nanowire based single photon detectors with very high efficiency at two technologically relevant wavelengths: 810 nm and 1550 nm. The detector will have several-fold enhanced sensitivity in comparison with semiconductor avalanche photodiodes and improved ability in comparison with commercial superconducting detectors. This in-house technology should augment our countries activities to develop secure communication channels both via fiber and free space.</p> <p>Interdisciplinary nature: The proposed research requires close interaction between Physicists, material scientists and electrical engineers. The proposed members are already closely working on several research avenues and have an excellent working platform with complementing expertise.</p> <p>Man-power requirements: A full-time PhD candidate is required to conduct experimental and theoretical work in parallel.</p> <p>End Users and Stake-holders: The proposed research has excellent commercial scope. The research is aimed at development of single photon detectors which are among the most urgent requirement for the quantum communication at present.</p>

PhD Supervisors (Equal contributions)			
Role	Faculty	Academic Unit in IITD	Email ID
Supervisor 1	Krishna Balasubramanian	Material Science and Engineering	bkrishna@mse.iitd.ac.in
Supervisor 2	Rajendra Singh	Physics	rsingh@physics.iitd.ac.in

Project requirements (Student qualifications, experience required, etc)

- MSc/ME in Physics/Chemistry/Materials Engg with background/interest in experimental research
- Interest to learn and conduction research in inter-disciplinary field

Source of funding (IRD/FITT Project details, if any)

We are in receipt of in-principal approval from DRDO. The complete financial approval is in process. We also propose to recruit candidates with external funding such as CSIR JRF or use the institute permitted MHRD quota for the research.

Role of Faculty Members involved:

K. Balasubramanian: Superconductor Material development, single photon detection and analysis

R. Singh: Nanoscale device fabrication and physical aspects of nanoscale superconducting devices