Title of the project:
Generation of entangled photons and its applications to Quantum Computation and Information Processing

Funding agency: Interdisciplinary Cyber Physical Systems (ICPS) of Department of Science and Technology

Duration: 3 Years (2019-2022) & Completion date: April 2022

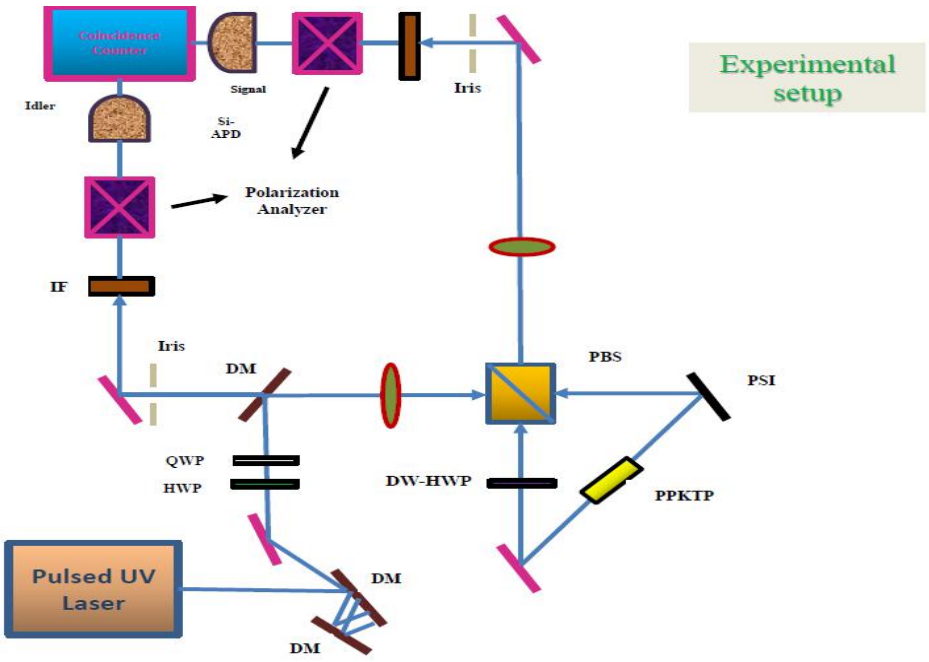
Project PI: V. Narayanan

Project Co-PI: Subhashish Banerjee

A brief description of the Objective of the project:

Experimental generation, characterization and desired manipulation of nonclassical states are challenging tasks. Non-classical states that are useful for quantum communication and quantum information processing will be generated efficiently. Generated nonclassical states will also be characterized appropriately. The development of Single Photon Source and its characterization, potential applications of it in the domain of defence will be explored. The investigation would be mixture of study of theoretical and experimental facets of laser matter interactions that has applications in quantum information. In the theoretical front, new schemes for quantum communication will be developed in such a manner that it can be realized using the nonclassical states generated.

Schematics or Pictures:



Title of the project: Quantum Heat Engines

Funding agency: Interdisciplinary Cyber Physical Systems (ICPS) of Department of Science and Technology

Duration: 3 Years (2019-2022) & Completion date : April 2022

Project PI: V. Narayanan

Project Co-PI: Subhashish Banerjee

A brief description of the Objective of the project:

Even though the role of quantum correlations (more generally, non-classical correlations) is well understood in some natural phenomena, there are plenty of other phenomena where the former can potentially play pivotal role, Quantum Thermodynamics being one such area. When the medium of heat engines are quantum mechanical objects, the work and/or the efficiency of the engine may turn out to be characteristically different from their classical counterparts. More surprises can occur when interaction is present among the quantum subsystems comprising the medium – as has been revealed – in the zero power case (i.e., infinite time is taken for thermalization) – for the case of two spin-1/2 systems and two quantum harmonic oscillators in the presence of quadratic interactions in Otto engine . For a more realistic scenario (i.e., non-zero power case), we need quantum open system approach to the action of the engine, which is one of the main goals of this project. This will then be used to formulate – in a comprehensive manner – the laws of Quantum Thermodynamics with the aim of achieving the usual laws of Thermodynamics in the macroscopic limit. We will also look at the characters of non-linear resources in Hamiltonians of the medium of quantum heat engines to get better efficiencies. All of these are expected to be done, keeping in mind, some physical implementations (like single-atom heat engine, etc.).

Schematics or Pictures: