

An Indian-Australian research partnership

Theory and Numerical Simulation of Spin Polarized Single-Photon Light Sources

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Research Academy theme/s

List only the research academy theme/s that is relevant to the project

1. Advanced computational engineering, simulation and manufacture
2. Nanotechnology

The research problem

Single photon light sources are becoming very attractive because of emerging applications in areas such as biomedical instrumentation and high speed inter/intra chip communications. Spin-polarized light sources are a new class of devices where in which a single photon sources coupled with electrical spin injection from a ferromagnetic contact can emit spin-polarized single photon light. This device consists of a p-i-n diode structure in a vertical cavity surrounded by a n-type ferromagnetic ring contact at the base and a non-magnetic mesa ring contact on top of the mesa. The device operation rely on electrical spin injection in a single quantum dot. The effect of photon- and spin-entanglement in a single/coupled quantum dot devices will also be explored theoretically. The optimum condition to maximize spin injection in the active region will be studied through spin-dependent tunnelling at the ferromagnet/semiconductor interfaces and spin transport through semiconductors.

Project aims

- Theoretical study of spin-injection into a single quantum dot.
- Theoretical study of spin- and photon-entanglement in coupled quantum dots.
- Spin injection, transport and detection in ferromagnet/semiconductor interfaces.

Expected outcomes

Theoretical design of Spin polarized nano-scale light sources

Which of the above Theme does this project address?

The project will design nano-scale spin-polarized light sources.

How will the project address the Goals of the above Themes?

Nano-scale light sources have wide applications including secure optical and intra/inter chip communications. The devices will be designed using various computation tools