IITB-Monash Research Academy

Indian Institute of Technology Bombay | MONASH University

An Indian-Australian research partnership

Fabrication and Experimental Characterization of Spin Polarized Light Sources

Project number: IMURA0164

Monash University supervisors: Prof. Zie Liu

IITB supervisors: Prof. Dipankar Saha

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

Spin polarized light sources (LED, Lasers and single photon 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 spin polarized electrons injected from a ferromagnetic contact into a active region emit spin-polarized light. This device consists of a p-i-n diode heterostructure structure in a vertical or Fabrey-Perot cavity. The device operation relies on efficient electrical spin injection in quantum dots or quantum wells. The devices will be theoretically designed and fabricated using various cleanroom technologies. The optimum condition to maximize spin injection in the active region will be theoretically explored and experimentally verified through spin-dependent tunnelling at the ferromagnet/semiconductor interface and spin transport through semiconductors. We intend to design, fabricate and characterize spin-polarized light sources for various applications.

Project aims

- Design, fabricate and characterize spin-polarized light sources.
- Study of spin-injection into quantum dots and quantum wells.
- Spin injection, transport and detection in ferromagnet/semiconductor interfaces.

Expected outcomes

Spin polarized light sources

Which of the above Theme does this project address?

The project will demonstrate spin-polarized light sources. The devices will first be theoretically designed and then fabricated and characterized using various nanotechnology methods.

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

Spin polarized light sources have wide applications including secure optical and intra/inter chip communications. The devices will be designed using various computation tools, and then experimentally realized using various nano-fabrication technologies.