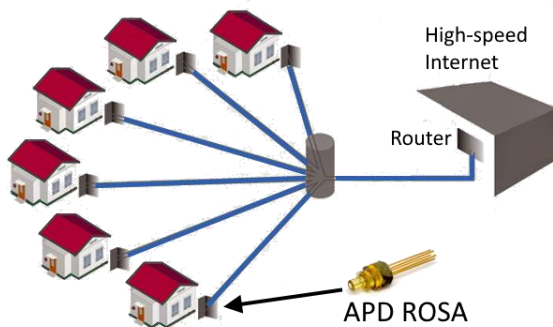


Semester Project: Impact ionization in Avalanche Photodiodes

The Big Picture

Global data traffic has exponentially grown over the last two decades, a trend set to continue due to increasing demand for higher capacity and faster data networks in applications like fiber-to-the-home, 5G and AI. Most data travels via fiber-optic networks, driving demand for faster, more efficient optoelectronic devices. Download and upload speeds are critical, especially in residential areas where remote work requires more data transmission from home offices. Avalanche photodiodes (APDs) are a key technology in this field, enabling higher sensitivity receivers for extended network reach.



Schematics Fiber-to-the-home (FTTH).

Thesis Description

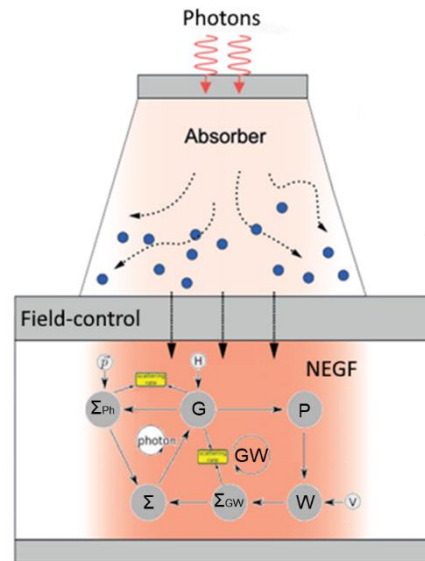
Despite APD widespread use in long-reach telecommunication transceivers, accurate description of the avalanche multiplication process remains challenging for the simulation tools.

Traditionally, APD characteristics are analysed using semi-classical Monte Carlo solvers and an analytical model of impact ionization. To better understand APD behaviour and improve performance, an *ab initio* quantum transport approach is needed, incorporating electron-electron and electron-photon interactions, especially under high-field conditions.

This project aims to simulate the InGaAs APD multiplication process using density functional theory and Non-equilibrium Green's Function (NEGF) formalism. Albis will support the simulation

with technical expertise and measurement data from its APD products.

Your Gain



Schematics of an APD.

- Better understanding of semiconductor device physics and simulation process.
- Improvement of your programming skills.
- Albis company visit with factory tour.

Albis

Albis Optoelectronics is a leading designer, developer and manufacturer of high-speed photodiode chips. The company offers a diversified product portfolio consisting of InP and GaAs based PIN photodiodes, APDs and high-speed detector modules up to 60 GHz. These photodiode products are completely manufactured in-house in fully owned clean-room facilities located in Rueschlikon.

Contact

Looking for 1 Semester student;

Interested candidates please contact:
ETH Professor: Prof. Mathieu Luisier →
mluisier@iis.ee.ethz.ch