Alexandre Walker

Project 11 Novel III-V and I-III-VI Based Multi-Junction Solar Cells
Supervisor: Dr. Karin Hinzer
Institution: PhD student in Physics at the University of Ottawa
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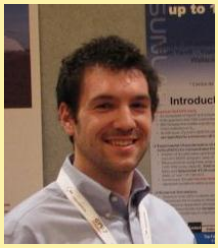

My research goal is to develop a 3D model of a multi-junction solar cell enhanced with nanostructures in order to increase the photoconversion efficiency compared to a generic device. This calibrated model can be used to predict the opto-electronic characteristics of these devices under realistic operating conditions such as high concentration illumination, as well as to enhance the design of multi-junction solar cells.
Questions and answers:

1. What are the modeling and simulation challenges and goals involved in other projects within the PVIN?
Organic solar cell groups are performing rigorous DFT calculations to compute energy band structures of organic molecules. These modeling calculations are very important in developing new organic solar cells with optimal properties. However, the research group did not focus much of their work on the challenges involved in calibrating their models. Another group (Ray LaPierre's group) was using COMSOL modeling and simulation software to study nanowire solar cells composed of GaAs, and in the future, tandem inorganic nanowire solar cells. This latter kind of modeling and simulation was very interesting to me since it is closely tied to my research.

2. What kind of materials and structures are under focus for up and down converters for the application of single junction solar cells?
The current focus of the McMaster group on project 8 is on the growth and characterization of silicon nanocrystals for the purpose of down conversion. The most interesting aspect of these optical devices is the energy band structure of such crystals, which are highly dependent on the growth conditions. At the moment, the research group is in the process of developing a characterization method to establish the efficiency of these devices as down converters.

3. What are the research goals for advancing single junction Silicon solar cells?
Decreasing the costs of the cells and modules can be achieved by decreasing the thickness of Si by a factor of 10. However, in order to maintain high photoconversion efficiencies with such a decrease in the material, significant advancements in light trapping techniques are being explored. These mainly focus on integrating photonic crystals within the ultra-thin Si devices. The research group also intends on researching heterojunctions with ultra-thin Silicon devices.