

## ***Master/PhD Student(s) in Theoretical Solid State Physics/Material Science***

**Project:** Modeling of structural and transport properties in disordered semiconductors with application to medical imaging

**Description:** Our current focus is on study of the charge transport in amorphous selenium (a-Se) and PbO for solid-state imaging detectors. PbO combines a high x-ray stopping power and a low exciton binding energy that results in an exceptionally high x-ray to charge conversion efficiency. Preliminary experiments on x-ray detectors based on PbO, however, revealed serious problems with a signal lag and ghosting that hinders further development of a detector for real-time imaging, such as cardiac applications. The origin of the signal lag and ghosting in PbO is unknown. Detector for gamma-rays (positron emission tomography) and for low-energy x-rays (mammography) will utilize an effect of avalanche charge multiplication in a-Se, which is proven experimentally, but its physical nature is still unknown. Disorder structure of these materials precludes application of standard approaches to modeling of the charge transport developed for crystalline semiconductors. Successful candidates will work on modeling of relevant electronic processes in a-Se and PbO, which include generation and dissociation of excitations, their transport and trapping by defects. Detailed calculation will require developing of a model of the atomic structure, calculations of the electronic structure using the density functional theory, study of vibrational properties and electron-phonon interaction.

**Qualification:** Completed Physics or Engineering university program + a good background in solid state physics, principles of quantum mechanics, and programming. The applicant should also meet the formal admission criteria (<http://mycoursecalendar.lakeheadu.ca/pg621.html>) of Lakehead University.

**Details:** Student will be enrolled into the graduate program at Department of Physics (<http://physics.lakeheadu.ca/index.php>) Lakehead University;

Starting date - open; a limited amount of stipends is available.

**Application:** Please e-mail cover letter, resume, and **transcript** to:

Dr. Oleg Rubel  
Scientist TBRI  
290 Munro  
Thunder Bay, Ontario, P7A 7T1  
rubelo@tbh.net

**Deadline:** Open