Lakehead UNIVERSITY | Department of Physics

INVITES YOU TO ATTEND THESIS PRESENTATIONS BY PHYS 4501 STUDENTS:

JORDAN LOVIS

“Monte Carlo Calculation of Radiation Dose Delivered by a Medical Linear Accelerator”

Supervisor: Dr. Peter McGhee

Radiotherapy uses various techniques and equipment for localized treatment of cancer with ionizing radiation. Medical linear accelerators (linacs) are routinely used to produce high-energy beams of ionizing radiation. Among the many algorithms employed for calculation of dose distribution, Monte Carlo based methods have proven to be the most promising in terms of accuracy. Full Monte Carlo calculations of dose are viewed as the "gold" standard in dosimetric measurements, however are not yet practical for clinical use as they are computationally intense. These calculations determine the transport of radiation and its energy deposition in complex and clinically significant configurations. Monte Carlo calculations for application in radiotherapy are divided into two parts. The first part entails modelling of the radiation beam produced by the linac, which results in a phase space representation of physical properties of the beam. The phase space contains information such as energy, position and direction for millions of particles constituting the beam. The second part of the calculation projects the informations contained within the phase space file upon user-defined structures to determine the dose distribution. The aim of the current work is to create a model of a 6 MV radiotherapy beam produced by a medical linac. The Monte Carlo code BEAMnrc is used for the generation of phase space files that are often used to determine dose distributions. Validation of this model is achieved through comparison of calculated and measured dose.

DEVIN VAN ELBURG

“Solid State Radiation Survey Meter for Advanced MRI-Guided Radiotherapy”

Supervisor: Dr. Alla Reznik

Cancer treatment with ionizing radiation must be done in a matter that is effective in the dose delivery to the tumour, but also adequate in sparing healthy tissue. High-dose rate (HDR) brachytherapy proves to be one of the most optimal radiotherapy procedures for reducing dose to healthy tissue. Today, brachytherapy treatment is planned based on computed tomography (CT) followed by computer simulation; the actual procedure is done blind. There is a growing trend for magnetic resonance imaging (MRI) guidance to control radiotherapy delivery for cancer treatments, especially brachytherapy. Compared to other imaging modalities, MRI provides superior soft-tissue contrast, which is needed for high precision radiotherapy of cancer targets.

Implementing MRI-guided radiotherapy procedures in a clinical setting requires the satisfaction of many safety precautions, including a requirement to survey the procedure room for residual radiation. However, conventional radiation survey meters based on vacuum photomultipliers (PMTs) are not MR-compatible and cannot be used in MR rooms. The overall objective of this research is to design, fabricate, and evaluate MR-compatible radiation survey meters for MRI-guided brachytherapy. The specific aim of the proposed HBSc project is to optimize the design of a radiation survey meter based on a magnetic-field-insensitive silicon photomultiplier (SiPM).

DATE: **Wednesday, MARCH 30th, 2016**

TIME: **2:30** PM

Room: **CB 4058**