

**M.Sc. Defense**  
**Evan Rand**  
**DATE: Wednesday April 20<sup>th</sup>, 2011**  
**TIME: 10:30a.m.**  
**PLACE: MacNaughton 222**  
**University of Guelph**

**THESIS TITLE: GEANT4 SIMULATIONS FOR THE RADON ELECTRIC DIPOLE MOMENT SEARCH AT TRIUMF**

**ABSTRACT:**

The existence of a permanent electric dipole moment (EDM) requires the violation of time-reversal symmetry (T) or, equivalently, the violation of charge conjugation C and parity P (CP). Although no particle EDM has yet been found, current theories beyond the Standard Model, e.g. multiple-Higgs theories, left-right symmetry, and supersymmetry (SUSY), generally predict EDMs within current experimental reach. In fact, present limits on the EDMs of the neutron, electron and  $^{199}\text{Hg}$  atom have significantly reduced the parameter spaces of these models. The measurement of a non-zero EDM would be the first direct measurement of a violation of time-reversal symmetry, and it would represent a clear signal of CP violation from physics beyond the Standard Model. The search for an EDM with radon has an enticing feature. Recent theoretical calculations predict substantial enhancements in the atomic EDMs for atoms with octupole-deformed nuclei, making odd-A Rn isotopes prime candidates for the EDM search. Such measurements require extensive development work and simulation studies. The Geant4 simulations presented here are an essential aspect of these developments. They provide an accurate description of  $\gamma$ -ray scattering and backgrounds in the experimental apparatus and  $\gamma$ -ray detectors, and are being used to study the overall sensitivity of the RnEDM experiment at TRIUMF in Vancouver, B.C.

**EXAMINING COMMITTEE:**

Chair: Dr. Robert Wickham

Advisor: Dr. Carl Svensson

Advisory Committee Member: Dr. Paul Garrett