

**M.Sc. Defense**  
**Ryan Massey**  
**DATE: Thursday June 16<sup>th</sup>, 2011**  
**TIME: 8:30a.m.**  
**PLACE: MacNaughton 222**  
**University of Guelph**

**THESIS TITLE:**

Tidal Deformations of a Schwarzschild Black Hole

**ABSTRACT:**

This presentation explores the effect of a tidal perturbation on the Schwarzschild geometry. I overview the procedure for performing a gauge transformation in order to simplify solutions to the perturbation fields. Both the light-cone coordinates and gauge, formulated by Preston and Poisson, are discussed as an alternative to the popular Schwarzschild coordinates and Regge-Wheeler gauge. Solutions to the perturbations in this light-cone gauge, found by Poisson and Vlasov, are simplified using a coordinate transformation to the order of  $R^{-3}$ , but it is found that higher order solutions cannot be simplified. I then formulate expressions for the intrinsic and extrinsic geometry of the perturbed Schwarzschild horizon. A gauge transformation is performed on the results, and it is found that while the intrinsic quantities are gauge-independent, the extrinsic quantities are not. The reason for this gauge dependence is explored, and gauge independent combinations of these quantities are found.

**EXAMINING COMMITTEE:**

Chair: Paul Garrett

Advisor: Eric Poisson

Advisory Committee Members: Luis Lehner, Ed Thommes