Junior WIC Geometric Analysis Seminar, December 12th 2014

1.15 – 1.40: *Magdalena Rodrguez*, **Minimal annuli with finite total curvature in $\mathbb{H}^2 \times \mathbb{R}$**
In the classical theory of minimal surfaces of the Euclidean space, the better known ones are those with finite total curvature. Laurent Hauswirth and Harold Rosenberg started in 2006 the corresponding theory of complete minimal surfaces with finite total curvature in $\mathbb{H}^2 \times \mathbb{R}$, the product space of the hyperbolic plane and the real line. Very recently, Hauswirth, Nelli, Sa Earp and Toubiana proved that a complete minimal surface with finite total curvature in $\mathbb{H}^2 \times \mathbb{R}$ must be proper, with finite topology and each one of its ends must be asymptotic to a polygon with a finite number of edges contained in the infinite boundary of $\mathbb{H}^2 \times \mathbb{R}$. I will present a joint work with Laurent Hauswirth and Ana Menezes, where we show that these conditions are not only necessary but also sufficient for embedded polygons at infinity.

1.45 – 2.10: *Lucas Ambrozio*, **CMC foliations and small perturbations of static black holes**
The talk will be divided into three parts. First, we will discuss foliations of three-manifolds by constant mean curvature spheres and how they can be used to establish scalar curvature rigidity results. Then, we will explain how the implicit function theorem can be used to construct such foliations. Finally, we will use these ideas to prove Penrose inequalities for small perturbations of the Schwarzschild-de Sitter and the Schwarzschild-anti de Sitter spaces of positive mass.

2.15 – 2.40: *Arick Shao*, **Uniqueness theorems for waves from infinity**
Uniqueness and unique continuation have been general problems of interest in the study of partial differential equations for several decades. In this talk, we survey some recent uniqueness results (joint works with various authors) regarding linear and nonlinear wave equations with data given at infinity, and we describe various applications. These results can be interpreted as determining whether waves can be reconstructed from radiation emitted toward infinity, and they can be connected with the physical intuition that a lack of radiation should imply the triviality of the underlying solution.

2.45 – 3.25: **Coffee and Cake**

3.30 – 3.55: *Claude Warnick*, **Black holes and the resolvent for conformally compact manifolds**
A black hole responds to small perturbations by ringing like a bell. The associated characteristic frequencies are complex, representing behaviour that is both oscillatory and decaying. There is a deep connection between this behaviour and properties of the resolvent for conformally compact manifolds. I will discuss how recent work on black holes provides a novel proof of a classical result of Mazzeo and Melrose.

4.00 – 4.25: *Constante Bellettini*, **Some mass minimizers in geometry: calibrated currents**
We will describe calibrations, a very important class of differential forms that is closely realated to many geometric questions, from the Plateau problem in Geometric Measure Theory to bubbling issues in Gauge Theory.

4.30 – 4.55: *Alessandro Carlotto*, **Localization of data in General Relativity**
A well-known corollary of the Positive Mass Theorem by Schoen-Yau is that a metric on the Euclidean space that has nonnegative scalar curvature and is flat outside a compact set has in fact to be globally flat, namely trivial. In other words, the constraint that the scalar curvature be nonnegative does not allow

localization of data in a compact domain. What is then the optimal localization of a metric of nonnegative scalar curvature? This is answered in a recent joint work with Schoen, where the gluing scheme we perform allows, among other things, to construct exotic solutions to the Einstein equations that exhibit the property of full gravitational shielding for arbitrarily long times. I will briefly present these results and then mention their counterpart in the asymptotically hyperbolic context, where one can use such methods to produce combinations of conformally compact manifolds.

6.30 : **Dinner at Otto's Restaurant**