THE CHINESE UNIVERSITY OF HONG KONG
Department of Mathematics
MATH 6022B (Second term, 2021-22)
Topics in Geometry II
Course Outline

Course Description

This is a graduate level topics course on geometry. This term we will focus on the geometric aspects of mathematical general relativity. Many problems in general relativity are essentially geometric in nature, in the sense that they can be understood in terms of Riemannian geometry and partial differential equations. This course will be centered around the study of mass in general relativity using the techniques of geometric analysis. More specifically, we will give an overview of the positive mass theorem and other related results such as Penrose inequality, drawing on a variety of tools used in this area of research, including minimal hypersurfaces, conformal geometry, inverse mean curvature flow, conformal flow, spinors and the Dirac operator, marginally outer trapped surfaces, and density theorems. We shall assume as prerequisite a working understanding of Riemannian Geometry (at the level of MATH5061), as well as basic knowledge on elliptic partial differential equations (at the level of MATH5022). In particular, prior exposure to general relativity is helpful but not absolutely required.

Instructor

- LI Man-chun Martin (Office: LSB 236. Email: `martinli@math.cuhk.edu.hk`)

Time and Venue

- Lectures: Thursdays 3:30-6:15PM

- **Venue**: LSB 219

Assessment Scheme

- **Final Essay/Presentation**: 100%

  You have to submit a mathematical essay on a proposed topic by the end of the semester. There is no prescribed length for the essay, but a reasonable range is something between 5000-8000 words. The deadline to submit the essay (by email) is **May 5, 2022**. One week before the submission deadline, i.e. during the lecture time on **Apr 28, 2022**, you will give a presentation for an overview of the content of your essay. Some suggested topics for the essay and other details will be announced during the semester.

Course Webpage

Please check regularly the following course webpage for course materials and announcements:

`http://www.math.cuhk.edu.hk/course/2122/math6022b`

Textbook and References

I will be following rather closely the following textbook:

- Dan A. Lee, *Geometric Relativity*, AMS Graduate Studies in Mathematics Vol. 201