AGR 2022 - Workshop Lectures Schedule May 16-17

https://atlanticgr2022.ca/

Day 1: Monday May 16

all times in NL time zone (GMT-2:30)

Time	Speaker	Title
0945-1000	Ivan Booth and Hari Kunduri	Welcoming remarks and organizational details
1000-1130	Carla Cederbaum	Where is the center of mass of an isolated relativistic object? (I)
1230-1330	Daniel Pook-Kolb	Introduction to black hole apparent horizons in numerical relativity (I)
1345-1445	Daniel Pook-Kolb	Introduction to black hole apparent horizons in numerical relativity (II)
1530-1630	William East	How to extract energy from a black hole (I)
1645-1745	William East	How to extract energy from a black hole (II)

Day 2: Tuesday May 17

all times in NL time zone (GMT-2:30)

Time	Speaker	Title
1000-1130	Carla Cederbaum	Where is the center of mass of an isolated relativistic object? (II)
1230-1330	Daniel Pook-Kolb	Introduction to black hole apparent horizons in numerical relativity (III)
1400-1500	William East	How to extract energy from a black hole (III)
1500-1700	***Gather*** meeting event	link to be updated

Please note that Professor Cederbaum will be giving two 1.5-hour lectures whereas Professor East and Dr Polk-Kolb will be giving three 1-hour lectures.

Workshop Lectures

Where is the center of mass of an isolated relativistic object?

Carla Cederbaum
Universität Tübingen

In this mini-course, we will study relativistic initial data sets and their total "charges". We will begin by defining initial data sets for relativistic spacetimes, including some examples. Then, we will discuss the asymptotic flatness conditions that ensure that the relativistic system modeled by an initial data set is isolated. The central part of the course will be to review how to define asymptotic/total charges such as energy, mass, linear and angular momentum, and, most prominently, the center of mass of asymptotically flat initial data sets. Our review will include traditional approaches by Arnowitt, Deser, and Misner (ADM) as well as geometric approaches by Huisken and Yau and by myself and Sakovich. We will end by describing open problems in this field of research.

Introduction to black hole apparent horizons in numerical relativity

Daniel Pook-Kolb
Max-Plank-Institut für Gravitationsphysik (Albert Einstein Institute) Hanover

This mini-course will cover the concept of apparent horizons and the techniques we use today to find them in simulations of black hole mergers. We will start with trapped surfaces, trapped regions and marginally outer trapped surfaces (MOTSs) introduced by Penrose and Hawking. The world tubes the MOTSs trace out in time then lead us to the definition of the quasilocal (isolated and dynamical) horizons introduced by Ashtekar, Krishnan and others. We will next discuss numerical methods used to locate MOTSs in initial data and in simulated spacetimes, both with and without additional assumptions about symmetries. Finally, we will have a closer look at recent results, which paint an intricate picture of the merger of two black holes. The stability properties of MOTSs will help in the interpretation of these results, and so we will give some room to the "MOTS stability operator" introduced by Andersson, Mars and Simon.

How to extract energy from a black hole

William East
Perimeter Institute of Theoretical Physics

IThough an object falling through a black hole horizon can never escape, remarkably, it is still possible to extract energy from a spinning black hole. We will cover the connection between this fact and black hole thermodynamics, and various ways in which black hole energy extraction can be realized, including the particle process originally proposed by Penrose, and the wave analogue called superradiance. In the final part, we will discuss the superradiant instability, and how this can turn astrophysical black holes into particle detectors for ultralight bosons.