

III- GRAVITATIONAL LENSING

IV- GRAVITATIONAL WAVE (GW) EMISSION

V- TIMING OF MILLISECOND PULSARS

VI- FORMATION, EVOLUTION AND DYNAMICS OF MASSIVE BLACK HOLES (MBHs)

2- MBH growth along the cosmic history

3- Formation and evolution of massive black hole binaries (MBHBs)

Prerequisites

None, besides the basic classes of the bachelor

Teaching form

56 hours of frontal lectures, mostly at the blackboard, occasionally with the support of slides.

Lectures will be in English.

Because of COVID, lectures will be distributed in remote. I will use the lectures recorded for the academic year 2019/2020 (the program hasn't changed). Lectures will be uploaded on e-learning the day before the actual schedule of each individual lecture, as specified in the academic calendar.

Textbook and teaching resource

Supporting material will be uploaded on e-learning during the course of the semester, in any case here follows an (incomplete) list of useful references.

I- SUMMARY OF SPECIAL AND GENERAL RELATIVITY

Barbara Ryden, "Introduction to cosmology", Chapter 12: http://carina.fcaglp.unlp.edu.ar/extragalactica/Bibliografia/Ryden_IntroCosmo.pdf
Abraham Loeb, "First Light": <https://arxiv.org/abs/astro-ph/0603360>

2-First baryonic structures: seed black hole formation

Marta Volonteri, "Formation of supermassive black holes": <https://arxiv.org/abs/1003.4404>

3-MBH growth along the cosmic history

Celoria et al., "Lecture notes on black hole binary astrophysics": <http://adsabs.harvard.edu/abs/2018arXiv180711489C>
King et al., "Aligning spinning black holes and accretion discs": <http://adsabs.harvard.edu/abs/2005MNRAS.363...49K>

J. Binney & S. Tremaine, "Galactic Dynamics", 1987 (dynamical friction, loss cone theory, stellar hardening)

D. Merritt, "Dynamics and Evolution of Galactic Nuclei", 2013 (dynamical friction, loss cone theory, stellar hardening)

V- GRAVITATIONAL WAVES FROM BINARY SYSTEMS

Semester

First semester.

Assessment method

Oral examination. The student will first be asked to elaborate on a topic of his choice for about 15-20 minutes. In the rest of the exam, the lecturer will ask other questions covering any of the topics treated in class.

There will be no intermediate examinations nor homework.

If the COVID situation persists at the time of exams, those will be held remotely using the teleconference platform Zoom.

Office hours

Any day is possible, so long as an appointment is requested via email. I generally use Zoom for remote meetings.
