UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Quantum Gravity

2324-1-F1701Q136

Aims

Introduction to the challenges of quantum gravity.

Contents

1. Challenges related to the quantization of gravity.

2. Black hole thermodynamics and the information paradox.

3. Introduction to holography and the AdS/CFT correspondence.

Detailed program

Semi-Classical Quantum Gravity

- Non-renormalizability of gravity.

- The cosmological constant problem.

- Black holes. Hakwing radiation, black hole thermodynamics, the black hole information paradox.

Introduction to the AdS/CFT Correspondence

- Introduction to conformal field theory

- Anti de Sitter space and its geometrical features.

- Introduction to the AdS/CFT correspondence

- Tests of the duality

Prerequisites

Courses of General Relativity and Theoretical Physics I and II.

Teaching form

Lectures

Textbook and teaching resource

-- black holes:

- T. Hartman, lectures on black holes: http://www.hartmanhep.net/topics2015/
- Caroll, an introduction to general relativity, chapter 9
- Review on the cosmological constant problem: https://arxiv.org/abs/1205.3365
- D. Harlow, Jerusalem lecture notes on quantum information and black holes: https://arxiv.org/abs/1409.1231
- A. Tomasiello, Lectures on quantum gravity

-- Introduction to the AdS/CFTcorrispondence:

• MAGOO review: https://arxiv.org/abs/hep-th/9905111
• McGreevy introduction: https://arxiv.org/abs/0909.0518
• Kraus AdS3/CFT2: https://arxiv.org/abs/hep-th/0609074
• Penedones TASI notes: https://arxiv.org/abs/1608.04948
• Zaffaroni Lecture notes: https://virgilio.mib.infn.it/~zaffaron/lezioniLosannafin.pdf

More to be added

Semester

second semester, four hours per week.

Assessment method

Oral exam bases on the exposition of an argument not discussed during the lessons (to be agreed with the instructors) and some very general questions about the course.
The final evaluation will take into account the level of comprehension of the study topic and the clarity of presentation, as well as the way the student answers general questions concerning the main subjects introduced in the course.

Office hours

At the end of lectures or by appointment contacting:

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Sustainable Development Goals

QUALITY EDUCATION