

PHYS 470: Introduction to loop quantum gravity

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This course will be an introduction for undergraduates to loop quantum gravity. To our knowledge, this is the second time such a course is offered in the world. We will assume minimal prerequisites: some knowledge of Lagrangian mechanics, some quantum mechanics and special relativity.

Topics:

1. Introduction: quantum gravity, why, what?
2. Special relativity and electromagnetism.
3. Some elements of general relativity.
4. Hamiltonian mechanics including constraints and fields.
5. Quantum mechanics and elements of quantum field theory.
6. Yang-Mills theories.
7. General relativity in terms of Ashtekar's new variables.
8. Loop representation for general relativity.
9. An application: loop quantum cosmology.
10. Further developments.
11. Open issues and controversies.

Grades for the course will consist 50% on homework (graded pass/fail) and a final presentation of a paper. A list of topics for the papers will be distributed later on. There is no textbook for the course, but the instructor will hand out detailed lecture notes. Homework and other information will be distributed through the course's website.