

Department of Physics and Astronomy
Course Outline: Introduction to Quantum Gravity, Physics 7990
Fall Semester, 2008, Classes in E791 W 15:30-17:30

Instructor:

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Office hours: M: 12:00-13:30, F: 15:00-17:00.

Reading:

(1)Euclidean Quantum Gravity, World Scientific (1993), G. W. Gibbons and S. W. Hawking (eds.).

(1a)Quantum Theory of Gravity I. The Canonical Theory, Phys. Rev. 160, 1113 (1967)-B. S. Dewitt

(1b)Quantum Theory of Gravity II. The Manifestly Covariant Theory, Phys. Rev. 162, 1195 (1967)-B. S. DeWitt

(1c)Quantum Theory of Gravity III. Applications of the Covariant Theory, Phys.Rev. 162, 1239 (1967)-B. S. DeWitt.

(2)Introduction to Modern Canonical General Relativity, arXiv: gr-qc/0110034-T. Thiemann.

(3)Background independent quantum gravity: A status report, arXiv:gr-qc/0404018-A. Ashtekar, J. Lewandowski.

(4)Quantum Gravity, Cambridge University Press (2004)- C. Rovelli (in Library).

(5)Lectures on non-perturbative canonical gravity-World Scientific (1991)-A. Ashtekar and R. Tate (in Library).

(6)Lectures Notes in Loop Quantum Gravity-B. Dittrich (Course Webpage).

Syllabus

Introduction: Basics of General Relativity, Path-integral formulation, Perturbative Gravity and non-renormalisation.

Canonical General Relativity:ADM coordinates, Hamiltonian, The Wheeler-Dewitt equation, Dirac Quantisation, Observables.

Background Independent Formulation: Sen-Ashtekar variables, C^* algebras, Kinematic Hilbert Space, Diffeomorphism and Hamiltonian Constraint .

Further Topics: The area and volume operators, Reduced phase space quantisation, Loop quantum cosmology, Spin foam models, Semiclassical Physics.

Grading: Assignments 40%, Midterm: 30%, Final 30%
Assignments will be given in each class.