PHYS 490/881

Relativity and Gravitation

COURSE DESCRIPTION:

Introductory course in general relativity and gravitation: self-contained introduction to differential geometry, gravity as geometrical theory and physics in a curved spacetime, black holes, and cosmology. *More advanced topics if time permits.*

RECOMMENDED TEXTBOOKS:

- *Spacetime and Geometry: An Introduction to General Relativity*, S. Carroll
- *Gravity: An Introduction to Einstein's General Relativity*, J. B. Hartle

TOPICS:

- Review of special relativity and flat spacetime
- Manifolds, tensors, covariant derivatives, and curvature
- Gravity as geometry, geodesic motion
- Einstein's equations, Newtonian limit, gravitational waves
- Black holes: Schwarzschild solution, horizons, gravitational collapse
- Cosmology: Homogeneous expanding Universe model, large scale structure
- *Early Universe: inflation, reheating, nucleosynthesis, microwave background*
- *Quantum effects: evaporation of black holes, primordial fluctuations*
- *Cool but esoteric stuff: Extra dimensions, wormholes, warp drives, time machines*

GRADING:

Your progress will be marked on absolute scale. At the end of the course, assignment and exam marks will be combined in a weighted average, from which the final grade will be derived (with thresholds to be determined by me). The relative weights are:

Assignments (every other week)	50%
Mid-term (take-home)	15%
Final exam (open-book)	35%

Assignments are to be handed in on a due day by beginning of the class. Late assignments are accepted, but will be penalized at 5% of the mark per day late. *Late exams will not be accepted.* Failure to submit an assignment or attend an exam will result in zero marks. Attendance of lectures is at your discretion, but no notes will be provided.