Physics 387M: Relativity Theory I (Fall 1997)

Schedule: Tue, Thu 12:30 - 2:00 PM --- RLM 5.124 --- Unique # 54890

Instructor: M.W. Choptuik
Office: RLM 9.208A --- **Office Hours**: Mon, Wed 10:00-11:30 and by appointment
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Instructor's Home Page: http://wwwrel.ph.utexas.edu/Members/matt/welcome.html
Course Home Page:
http://wwwrel.ph.utexas.edu/Members/matt/Teaching/97Fall/Phy387M/Syllabus.html

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Recommended Text: *General Relativity* by R. M. Wald, The University of Chicago Press, 1984
Coop bookstore may be temporarily sold out, additional copies should be available by late next week.

Course Overview: This course will provide an introduction to the theory of general relativity. Coverage will roughly parallel the first six chapters, plus Appendices B and C, of Wald:

- 1. Introduction
- 2. Manifolds and Tensor Fields
- 3. Curvature
- 4. Einstein's Equation
- 5. Homogeneous, Isotropic Cosmology
- 6. The Schwarzschild Solution
- Appendix B. Differential Forms, Integration, and Frobenius's Theorem
- Appendix C. Maps of Manifolds, Lie Derivatives, and Killing Fields

See the syllabus below for a preliminary list of topics to be covered on a per-lecture basis. From time to time I will distribute course notes, but for the most part you will be responsible for taking notes in class.

Other References: Apart from Wald, there are a quite a number of standard textbooks and references on General Relativity. Three which I particularly recommend are

- *Gravitation* by Misner, Thorne and Wheeler
- *Gravitation and Cosmology* by Weinberg
- *A First Course in General Relativity* by Schutz

Copies of these will be placed on two hour reserve in the PMA library.

Grades: Homework and Exams:

Course grades will be determined on the basis of performance on a number of homework assignments, and on an open-book final exam, with the following weighting:

- Homework Assignments: 80%
- Final Examination (open book): 20%

The currently scheduled final examination slot is Monday, December 15, 9:00 -- 12:00 noon, but I intend to have the exam rescheduled earlier in the exam period since I will be travelling on Dec. 15th. You will be responsible for all material covered in class for the final.

Homework: Homework will be assigned roughly every two weeks, and will generally be due within one to two weeks. Late homework *may* be accepted at the instructor's discretion. As the course progresses, the Homework Schedule web page will contain information concerning current and past assignments. The weight of each individual homework towards your final mark will be based on the complexity and difficulty of the assignment.

*All homework **must** be submitted by December 4 (the last class day) at the latest.*

Computer Access:

Apart from lectures, my preferred means of communicating general course information will be via e-mail. All students should have an account on the Physics Dept. public Unix systems located in the Graduate Computer Lab, RLM 3.118. Please send me an e-mail message as soon as possible giving me *your* preferred e-maill address. You will be also be given remote access to the Center for Relativity Unix machines. Some of the homework assignments will require use of the Maple symbolic manipulation package and I will encourage you to use Relativity machines for that purpose.

Syllabus

Due	Tuesday	Thursday
		August 28 Introduction
	September 2 Manifolds and Vectors	*September 4* Tensors
	September 9 Tensors	*September 11* Derivative Operators
	September 16 Differential Forms and Integration	*September 18* Lie Derivatives
	September 23 Curvature	*September 25* Curvature
	September 30 Geodesics	*October 2* Computing Curvature
	October 7 Special Relativity	*October 9* General Relativity: Field Equations
	October 14 General Relativity: Field Equations	*October 16* Linearized Gravity
	October 21 Linearized Gravity	*October 23* Gravitational Radiation
	October 28 Schwarzschild Solution	*October 30* Schwarzschild Solution
	November 4 Geodesics of Schwarzschild	*November 6* Classical Tests
	November 11 Classical Tests	*November 13* The Kruskal Extension
	November 18 Black Holes	*November 20* Cosmology: Homogeneity & Isotropy
	November 25 Cosmology: Dynamics	*November 27* **Thanksgiving**
	December 2 Brief History of the Universe	*December 4* Review & Class Evaluation