Physics of the Dark: Ideas of Modern Physics

PHYS 1301 (Fall 2005) Syllabus

http://www.physics.smu.edu/~kehoe/1301

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Office hours: 11am-1pm Monday, or by appointment

Texts: *"The World Treasury of Physics, Astronomy and Mathematics"*, ed. T. Ferris
"From Paradox to Reality", F. Rohrlich
"A Tour of the Subatomic Zoo", C. Schwarz

Class Time: MWF 1pm – 1:50pm **Lab Time:** W 2pm – 4pm
Classroom: Rm 124 Fondren Science (Rm 25 for labs)

Course Objectives: We explore the modern quest to comprehend the universe at the micro- and macroscopic levels. Relativity and quantum mechanics will be examined and their implications will be discussed. Particle physics thru cosmology are covered at a descriptive level accessible to all SMU students. The course is designed to explore the concepts behind the calculations and findings.

Method of Instruction: Reading for the course will take from three texts. Ferris is an anthology of non-mathematical articles from major figures in modern physics. Schwarz supplies material for the particle physics facet of the course, while Rohrlich supplies relativity and quantum mechanics. Reading is a crucial element of your effort to acquire a firm grasp of the concepts in this course. The class will consist of lectures which provide the overall organization and coverage of the subject matter of the course. Lectures are given on Mondays and Wednesdays. The material for tests and quizzes will be taken directly from lecture. An optional period is available some Fridays at 1pm – 1:50pm in Rm 124 for discussion of key concepts and implications.

Quizzes and Tests: There is no graded homework for this class. There will be three quizzes on the lecture material. These will be scheduled at the beginning of designated lecture periods and will provide a total of 10% of your grade. There will be 3 tests during the semester, including the final exam. These will make up 40% of the class grade. The second test covers material since the first test. The final is cumulative over the whole course. Tests and quizzes are closed book and will be a combination of multiple choice and short 'essay' questions. A book report is 1/6 of the grade. The lab portion of the class is 1/3 of the overall grade.

Grading and Attendance Policy: In general, it is crucial to be clear and concise in your answers to get full credit for quiz or test questions. Regrading requests must be well justified

in writing. Anticipated absences resulting from religious observance or officially sanctioned extracurricular activity must be brought to the instructor's attention at least 2 weeks in advance. Affected quizzes or tests will be given prior to the rest of the class. No other make-up quizzes or tests will be granted. Attendance and note-taking is an important way to obtain material in lecture which is not covered evenly by the three texts.

Book Report: The book report is designed to provide an opportunity to explore in more detail one aspect of the scope of the course. The book must be chosen from the list below.

"Black Holes and Baby Universes", S. Hawking
"In Search of Schrodinger's Cat", J. Gribbin
"The Quantum World", Polkinghorne
"Hyperspace", M. Kaku
"The God Particle", L. Lederman
"The Matter Myth", P. Davies, J. Gribbin
"A Brief History of Time", S. Hawking
"Elegant Universe", B. Greene

The report is expected to be approximately 10-15 typed pages. Halfway thru the semester, the first half of the report is due for comments. A late mid-term submission will result in the report final grade being lowered by 10%. The final report is due on the last day of class, no late final submissions will be accepted.

Labs: The lab will consist of a combination of measurements, simulations and demonstrations relevant to modern physics topics. Lab reports for each lab will be due the Monday lecture following each lab. Your report will consist of brief abstract, data tables, responses to questions, error analysis, and a conclusion. It is important that you acquire, and demonstrate thru your lab report, an understanding of the measurements being made and sources of uncertainties in your measurements. There are no make-up labs.

Aug 24	no lab	Oct 12	no lab
Aug 31	Measurement and Error I	Oct 19	Diffraction and Spectra I
Sep 7	Measurement and Error II	Oct 26	Diffraction and Spectra II
Sep 14	Speed of Light	Nov 2	Bohr Model I
Sep 21	Special Relativity I	Nov 9	Bohr Model II
Sep 28	Special Relativity II	Nov 16	Radioactivity
Oct 5	Probability	Nov 23	no lab, Thanksgiving
		Nov 30	Cosmic Rays

Physics 1301 Schedule, Fall 2005

Date	Topic	Reading Assignments
Aug 22 M	Elemental Physics	
Aug 24 W	Classical Picture	Rohrlich 1-48
Aug 29 M	Problems with Light	Rohrlich 49-52
Aug 31 W	Problems with Light Spectra	Rohrlich 121-124
Sep 5 M	Quiz #1, Special Relativity 1	Ferris 56-59; Rohrlich 49-88
Sep 7 W	Special Relativity 2	
Sep 12 M	General Relativity	Ferris 194-202; Rohrlich 89-110
Sep 14 W	General Relativity 2	Ferris 346-359
Sep 19 M	Quanta	Rohrlich 125-133
Sep 21 W	Test #1	
Sep 26 M	Quantum Particles	Ferris 86-115; Rohrlich 134-157
Sep 28 W	Quantum Mechanics	Rohrlich 158-189
Oct 3 M	Atoms	
Oct 5 W	Nuclei	Ferris 50-55; Schwarz 1-13
Oct 10 M	Fall Break	
Oct 12 W	Stellar Evolution	Ferris 272-276
Oct 17 M	Quiz #2, Stellar Death	Ferris 203-240, 277-291
Oct 19 W	Galactic Observations	Ferris 292-320
Oct 24 M	Subatomic Zoo	Ferris 38-44, 80-85; Schwarz 29-35
Oct 26 W	Four "Forces"	Schwarz 19-23, 44-52
Oct 31 M	Another Unification	Schwarz 71-76
Nov 2 W	Test #2	
Nov 7 M	Fundamental Particles	Schwarz 57-65
Nov 9 W	Big Bang	Ferris 321-334, 360-364
Nov 14 M	Microwave Background	
Nov 16 W	Cosmological Nucleosynthesis	Ferris 170-183
Nov 21 M	Quiz #3, First 3 Minutes	Ferris 395-430
Nov 23 W	Thanksgiving, no class	
Nov 28 M	Dark Matter and Energy	
Nov 30 W	The Frontier	Ferris 116-146
Dec 1 F	Final Exam 3pm-6pm	— —