PHYS 1301 **Ideas of Modern Physics** **Fall 2016**

Course Overview

Everything you need to know about time travel, the Big Bang Theory, Schrodinger's cat, the Higgs boson … and more. This is an introductory course designed specifically for non-science majors. In a descriptive, non-mathematical framework, it presents the deepest ideas in modern physics – Relativity and Quantum Mechanics - and their impact on life, the universe, and everything, including the nature of space, time, matter, energy, reality and the high technology we take for granted. A variety of practical work, such as measuring the age of the universe, the speed of the fastest thing in the universe, the structure of the smallest atom, etc., as well as assessing societal impact, illustrates the course material in a form accessible to all.

Instructor Biography

Prof. Dalley has been teaching physics courses from non-science majors to graduate students at SMU since 2006. PHYS 1301 is his favorite course, which he developed over several years and for which he wrote a textbook. In 2013, Prof. Dalley received both an Outstanding Professor Rotunda Award and the Provost's Teaching Recognition Award. At SMU he also directs science outreach programs and professional development courses for high-school physics teachers.

Benefits of taking this course

- Gain a deeper understanding of the ideas of modern physics
- Acquire UC tags in an enjoyable and stimulating course
- Gain transferable skills in data analysis
- Improve your non-fiction writing skills
- Step back from your specialization and ruminate on the BIG picture

UC "tags" and Student Learning Outcomes

This course satisfies the Pure and Applied Sciences Level 1 Pillar and the Quantitative Reasoning Proficiency of the University Curriculum.

PAS I Pillar Learning Outcomes

- Demonstrate basic facility with the methods and approaches of scientific inquiry
- Explain how the concepts, advancements, and findings of modern physics shape our world

QR Proficiency Learning Outcomes

- Collect, organize and analyze data from a variety of sources
- Communicate and represent quantitative information or results numerically, visually, verbally, and in writing
- test hypotheses and make recommendations or predictions based on results

Class Meeting: (lecture) MF 12:00 – 12:50 pm Room 158 Fondren Science Bldg
(lab) W 1:00 – 2:50 pm or 3:00 – 4:50 pm Room 60 Fondren Science Bldg

Instructor: S. Dalley, Room 207 Fondren Science, sdalley@smu.edu
Office Hours: W 5:00 - 6:00 pm

Text: *Ideas of Modern Physics*, S. Dalley, 2nd ed., Kendall Hunt, 2016. ISBN 9781465292124

Website: http://www.physics.smu.edu/sdalley/1301_F16/1301home.htm

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Date	Assgn Due	Pre-class Reading & Quizzes
Mo 8/22		**Scientific Discovery** **1.1** Numbers in Science
We 8/24		LAB - **Numbers in Science**
Fr 8/26		**Classical Physics** **2.1** Space, Time, Motion
Mo 8/29		**Classical Physics** **2.2** Gravity
We 8/31		LAB - **Measurement and Error**
Fr 9/2	A	**Classical Physics** **2.3** Electricity & Magnetism
We 9/7		LAB - **Speed of Light**
Fr 9/9		**Classical Physics** **2.4** Light: Into the Modern Era
Mo 9/12	B	**Special Relativity** **3.1** Space, Time, Motion, Revisited
We 9/14		LAB - **Moving Clocks**
Fr 9/16		**Special Relativity** **3.2** Paradoxes (not)
Mo 9/19	C	**Special Relativity** **3.3** Energy and $E = mc^2$
We 9/21		LAB - **Magnetic Particle Accelerator**
Fr 9/23		**Special Relativity** **3.4** Space-Time
Mo 9/26	D	**General Relativity** **4.1** Equivalence Principle
We 9/28		LAB - **Free Fall**
Fr 9/30		**General Relativity** **4.2** Time Dilation and Light Bending
Mo 10/3	E	**General Relativity** **4.3** Curved Space-Time
We 10/5		LAB - **Hubble's Law**
Fr 10/7		**General Relativity** **4.4** Structure of the Universe
We 10/12		LAB - **Probability**
Fr 10/14	F	**Quantum Mechanics** **5.1** Wave-Particle Duality of Light
Mo 10/17		**Quantum Mechanics** **5.2** Probability & Uncertainty
We 10/19		**MID-TERM EXAM**
Fr 10/21		**Quantum Mechanics** **5.3** Matter Waves
Mo 10/24		**Quantum Mechanics** **5.4** Quantum Measurements
We 10/26		LAB - **Laser Diffraction**
Fr 10/28	G	**Atoms** **6.1** Structure and Properties
Mo 10/31		**Atoms** **6.2** Quantized Energy
We 11/2		LAB **- Hydrogen Spectrum**
Fr 11/4 *	H	**Atoms** **6.3** The Nucleus *** Drop**
Mo 11/7		**Atoms** **6.4** Condensed Matter
We 11/9		LAB **- Radioactivity**
Fr 11/11	I	**Synthesis** **7.1** Space-Time Revisited
Mo 11/14		**Synthesis** **7.2** Particles and Force-Fields
We 11/16		LAB - **makeup**
Fr 11/18	J	"Particle Fever" documentary Part 1
Mo 11/21		"Particle Fever" documentary Part 2
Mo 11/28		**Synthesis** **7.3** The Standard Model
We 11/30		LAB - **Particle Identification**
Fr 12/2	K	**Synthesis** **7.4** Unsolved Mysteries
Mo 12/5		*Review for Final*
Tu 12/13		**Final Exam 11:30am-2:30pm 158 Fondren Science**

GENERAL POLICIES

- The course homepage contains all information you will need (bookmark it now):

  http://www.physics.smu.edu/sdalley/1301_F16/1301home.htm

- I will use your official SMU e-mail address to communicate with you – please check it!
- Academic Dishonesty will result in a course F grade and filing with the Dean of Student Life.
- During class, phones should be put away and laptops used only for course-related tasks.

Assessment

QUIZZES (20%)

Before class you are expected to read relevant sections of the textbook and view supplemental material on the textbook website. Short multiple-choice quizzes, found in the textbook, should then be submitted at the **beginning** of the relevant class.

Recommended Time Burden = 1 hour per class

LABS (35%)

Each Wednesday there is a lab that illustrates the material covered in class.

Important: this course counts as a lab-based science pillar for the University Curriculum. If your average lab score is below **60 %**, your final grade will be determined by your lab score alone.

- Labs are performed with a random partner. Your partner will be unable to start until you arrive, so it is very important that you arrive **promptly** for labs at the start time of your section.
- The syllabus shows which lab is on which date. Labs are in rm 060 of Fondren Science.
- Lab descriptions are available on the course website. There is no need to print anything.
- You may make up **one** lab during the make-up session toward the end of the course. The makeup session must be used to cover any involuntary absences (such as illness).

ASSSIGNMENTS (30%)

Assignments consisting of 3 questions requiring **hand-written** extended responses are due most weeks and must be turned in at the **beginning** of class on the due date to gain credit. Assignments are linked on the course website and due dates shown on the syllabus. For each question on an assignment, the grading scheme is:

- 2 points – Mostly correct, some minor errors, omissions, or irrelevant material
- 1 point – some correct but major errors, omissions, or irrelevant material
- 0 points – Nothing correct or nothing relevant to the question asked.

You may use your own words, use wording from the textbook without attribution, and use wording from other sources with attribution; pasting from other sources without attribution will receive no credit. Indiscriminately including material not directly relevant to the question asked will reduce your credit.

Recommended Time Burden / Length = 1 hour / 1 page per assignment

MID-TERM + FINAL EXAM (5+10%)

The mid-term (20 multi-choice questions) covers Chaps 1-4. The final exam (40 multi-choice questions) covers all Chapters. Closed book and closed note. To focus your preparation, the questions will be provided a week in advance (but not the options for multi-choice answers!).

Recommended Time Burden = 2 + 4 hours preparation

Course Grade

Grade Boundaries are fixed

A > 90% > A - > 85% > B+ > 80% > B > 75% > B- > 70% > C+ > 65% > C > 60% > D > 50% > F

- Weight of different components: Labs 35%, Assignments 30%, Quizzes 20%, Midterm 5%, Final 10%.
- The lowest assignment score and lowest 2 quiz scores are dropped, including absence for any reason. Late assignments and quizzes are not accepted for credit.
- Averaging less than **60 %** in labs alone will result in your course score being your lab score.

Disability Accommodations: Students needing academic accommodations for a disability must first contact Ms. Rebecca Marin, Coordinator, Services for Students with Disabilities (214-768-4557) to verify the disability and establish eligibility for accommodations. They should then schedule an appointment with the professor to make appropriate arrangements.
(See University Policy No. 2.4.)

Religious Observance: Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence.
(See University Policy No. 1.9.)

Excused Absences for University Extracurricular Activities: Students participating in an officially sanctioned, scheduled University extracurricular activity will be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work.
(University Undergraduate Catalogue)