Syllabus

Physics 252 – **Modern Physics**

MWF 12:00 - 12:50

Instructor: Paul Fendley

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Office hours: Monday 10-12, Thursday 3-4, and by appointment

Webpage: `http://rockpile.phys.virginia.edu/252.html`

Homework will be handed in at the **beginning** of class every Friday. It will not be accepted late without prior approval from me.

TA: Patrick Keith-Hynes, Physics 328, 4-6782, `ptk4m@Virginia.edu`

Hoxton lecture: Every spring the physics department hosts a renowned physicist for a public lecture. If people attend in sufficient numbers, I will likely cancel class on the Friday before spring break.

Tests: The first midterm for the class will be on either Wednesday, Feb 28, or Friday, March 2. The second will be in the first part of April. Our final is on Friday, May 4.

Grading:

Final: 30%

Midterms: 15 % each

Homework: 30%

Section Quizzes: 10%

Texts:

Feynman, *Feynman Lectures on Physics*, volume 3

Born, *Einstein's Theory of Relativity*

Weinberg, *The First Three Minutes*

Fowler, `http://www.phys.virginia.edu/classes/252/home.html`

Fowler's lecture notes contain much interesting detail about the history of these discoveries as well as the physics. We won't be discussing the material in historical order, but I believe it will be worth your time to look through these as well as reading the texts – I'll try to indicate where you should look.

Other Texts:

My lecture notes from recent years are already on the web. The topics this year will be mostly the same, but not exactly, and not always in the same order. I will post this year's notes after I give the lectures. However, I advise you not to rely on these over your own notes and the textbooks.

There are many "standard" textbooks for this class, all called *Modern Physics*. Three examples have authors Bernstein, Fishbane and Gasiorowicz; Thornton and Rex; Tipler and Llewellyn. We will study roughly the same topics, so you will probably find it useful to consult any or all of these books. They are all OK, but the approach we will take is to reduce the number of topics but try to go into more depth.

Broad Outline:

Particles and Waves (Feynman ch. 1-3)

particle diffraction and interference, photons, uncertainty principle,
probability amplitudes

Quantization (Feynman ch. 4-5)

angular momentum and spin, bosons and fermions, black-body radiation, bases

Time Dependence (Feynman ch. 7-9)

energy and the Hamiltonian, masers/lasers, quantum computers

Electrons in Materials (Feynman ch. 13-14) (if we have time)

semiconductors, transistors

Position Dependence (Feynman ch. 16, 18.3, 19)

Schrödinger equation, the Einstein-Podolsky-Rosen effect,
hydrogen atom, periodic table

Special Relativity (Born ch. I, III-IV, V.14-15, VI)

relativity in classical mechanics, the speed of light, simultaneity and the interval

General Relativity (Born ch. VII)

Cosmology (Weinberg)

the expanding universe, the cosmic microwave background, the big bang

Particle Physics (in the unlikely event we have time left)

I'll give more detailed descriptions of the relevant reading as we go along (see last year's lecture notes if you'd like to read ahead).