

Physics 093

Fall 2009

Particle Physics Seminar #2

**Textbook:** Griffiths - Introduction to Elementary Particles

**Website:** (all notes referred to below are on web site)

[http://chaos.swarthmore.edu/courses/Phys093\\_2009/index.html](http://chaos.swarthmore.edu/courses/Phys093_2009/index.html)

**Readings:**

**REQUIRED:** Griffiths - Chapters - 3

01\_Ch19\_2ndQuant - 2<sup>nd</sup> Quantization

00\_SR\_EM - Relativistic Electrodynamics

**Topic(s):**

(1) Relativistic Kinematics

(2) 2nd Quantization

**Professor Lecture Topic: Second Quantization(continued)**

**Problems:**

Griffiths 3-04, 11, 15, 18, 19, 21, 25, 26, 27

**Extra Problem 1** - The W boson has a mass of  $80 \text{ GeV}/c^2$ , and a peak width of  $2.1 \text{ GeV}$ . Suppose that the Starship Enterprise wants to shoot a beam of W's at a Romulan warbird located 10,000 km away. To what energy should the Enterprise accelerate the beam so that the average boson goes at least that far?

**Extra Problem 2** - A pion in flight decays into a muon and a mu antineutrino. If the pion has a total energy of  $500 \text{ MeV}$  in the lab frame, what are the minimum and maximum possible energies of the muon after the decay, in the lab frame? What is the average energy of the muon, assuming that the pion's decay products have an isotropic distribution in its center-of-mass frame?