

PHY 556/714: Handout 5

Date: 11/28/2007

From: Krishna S. Kumar, <mailto:kkumar@physics.umass.edu>, LGRT 421, 5-1310

RE: *Topics, Reading & Assignment, lectures 20 thru 25, 11/27/07 thru 12/13/07*

In this last series of lectures, we will discuss some specialized topics that are the subject of current research. First, we discuss the neutral kaon system and introduce studies of CP violation. We will then have a brief introduction to nuclei and nuclear decays before discussing the solar neutrino deficit and neutrino oscillations. We will conclude the course with a brief overview of advanced topics such as radiative corrections, the QCD Lagrangian and asymptotic freedom.

Main Reading:

Lecture notes

Povh, Sections 3.1 thru 3.3, 17.1, 17.3, 17.6

Griffiths, Section 4.8, 4.9, 9.1, 9.4

Supplementary Reading:

Frauenfelder and Henley, Chapter 11

Homework Assignment 5 (due 12/21)

- 1) Use the shell model to predict the spin and parity (J^P) of the following three nuclei:
 - $^{33}_{16}\text{S}$, $^{27}_{12}\text{Mg}$, $^{41}_{21}\text{Sc}$
- 2) Classify the following beta-decays as allowed, first forbidden, Fermi or Gamow-Teller
 - ^3H to ^3He
 - $^{14}\text{O}(0^+)$ to $^{14}\text{N}^*(0^+)$
 - $^{36}\text{S}(0^+)$ to $^{36}\text{Cl}(2^-)$

- 3) Explain qualitatively why the following processes can be attributed to the weak force despite widely disparate lifetimes:
- Muon decay (2 microseconds)
 - Neutron decay (15 minutes)
 - $^{10}\text{Be}(0^+) \rightarrow ^{10}\text{B}(3^+)$ (1.5 million years)
- 4) Use the shell model to predict the spin and parity of the first excited state of the following three nuclei:
- ^7_3Li , $^{31}_{16}\text{S}$, $^{39}_{19}\text{K}$