362L Homework Set 3  
Feb. 19

[“H & G” refers to our textbook. This assignment is due in a week and a half; that is, it is due in class on Feb. 28. Show a complete solution to each question, explaining things in your own words. Many of the questions are quite simple and straightforward. Where specific information about various individual particles is needed, as a check on your result or to begin the setup of the solution, consult reliable on-line sources.]

(1) What is the charge-conjugate (C) reaction to $K^- + p \rightarrow \bar{K}^0 + n$? Can a $K^- + p$ system be an eigenstate of the charge conjugation operator? Give a similar discussion for the reaction $\bar{p} + p \rightarrow \pi^+ + \pi^-$. [Warning: this question is not trivially easy!]

(2) Which of the following particles or states are eigenstates of C? For the ones which are eigenstates, what is the eigenvalue? $|\gamma\rangle$, $|\pi^0\rangle$, $|\pi^+\rangle$, $|\pi^-\rangle$, $|\pi^+\rangle - |\pi^-\rangle$, $|\nu_e\rangle$, $|\Sigma^0\rangle$.

(3) 9.11 in H & G.

(4) 9.19 in H & G. Use Gaussian units!

(5) 9.37 in H & G.

(6) 9.43 in H & G.

(7) (a) 10.16 in H & G.

(b) 10.19 in H & G.

(8) Exited states with 0+ in nuclei are difficult to detect, because they can’t de-excite by photon emission to the ground state, which is always 0+ in a nucleus with an even number of neutrons and an even number of protons. Why not?