Astron 400 Problem Set 5

Given: Oct 9. Due: Thursday, Oct 16 at the beginning of class

Homework Policy: You can consult class notes and books. Always try to solve the problems yourself; if you cannot make progress after some effort, you can discuss with your classmates or ask the instructor. However, you cannot copy other's work: what you turn in must be your own. Make sure you are clear about the process you use to solve the problems: partial credit will be awarded.

Reading: Phillips Chapter 4

Problem 1 Phillips 4.6

Problem 2 Phillips 4.7

Problem 3 Reaction Energetics

Calculate the amount of energy released or absorbed in the following reactions (your answer should be in MeV):

  a. $^{12}\text{C} +^{12}\text{C} \rightarrow^{24}\text{Mg} + \gamma$

  b. $^{12}\text{C} +^{12}\text{C} \rightarrow^{16}\text{O} + 2 \times^{4}\text{He}$

  c. $^{19}\text{F} + p \rightarrow^{16}\text{O} +^{4}\text{He}$

The mass of ^{12}C is 12.0000 amu, by definition. The masses of ^{16}O, ^{19}F and ^{24}Mg are 15.99491 amu, 18.99840 u, and 23.98504 u, respectively. Are these reactions endothermic or exothermic?

Problem 4 GS: Non-linear Fitting

Go to `http://www.gravity.phys.uwm.edu/~kaplan/astron400.html` and download the two data-sets for this problem, A and B. Your task is to fit a function of the form:

$$y = Ae^{-(x-\mu)^2/2\sigma^2}$$

to the data. The first column is x, and the second is y. Each data-set was created with a particular choice of (A, μ, σ) with some random noise added in. You should fit the model to

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the data and provide me with your best-fit parameters along with a curve comparing your fit to the data.