Astronomy 422 Cosmology Homework Assignment #3 – Due 11:00 am April 8th
80 points

Please explain your answers in complete sentences where called for. Although collaboration is encouraged, remember to answer in your own words. Where math is involved, please be sure to show all your work, and answer in no more than a reasonable number of significant digits.

1. (20) Imagine a really weird equation of state originally proposed by the Russian scientist Chaplygin very early on in the 20th century as part of an *ad hoc* model regarding stellar atmospheres (in other words, nothing to do with cosmology at all):

$$p = -\frac{A}{\rho} \qquad \text{(hw3.1)}$$

   a. (10) Solve for the dependence of ρ on a for this weird stuff (don't do anything with A or your constant of integration just yet).

   b. (10) Comment on the behavior of ρ as $a \to 0$ and as $a \to \infty$. Identify A from hw3.1 above and your constant of integration with their obvious counterparts from class. Alas, if it were only this easy.

2. (20) You'll recreate figure 7.1 (except the upper left corner "No Big Bang" line; we'll talk about that later).

   a. (5) Show the math equations which describe the lines you plot.

   b. (5) Our best estimates for $\Omega_{m,0}$ and $\Omega_{\Lambda,0}$ can be found hidden in the table on page 165 in your book (as per convention, the $\Omega_{\Lambda,0}$ doesn't have a zero subscript there: you can assume it should). Pull those values out by disentangling them from the h^2 factor, ***including*** the error bars.

   c. (10) Plot the 1-σ contour lines on your version of figure 7.1; that's why you carefully included the error bars in part b. above.

3. (15) Problem 7.5 in the book.

4. (15) Problem 8.4 in the book.

5. (10) Plot the upper curve in figure 8.1. (Note that you are plotting your answer to number 4. above = 8.4 in the book.)