

## Physics 3002, Problem Set 9, due 4/15/09

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1. Ryden problem 7.7. In this problem, you are asked to show that the total physical area (measured today) of a sphere with a radius  $r$  (here,  $r$  refers to the coordinate radial distance, not a physical distance) is given by equation 7.24. You should be able to show this starting from the Robertson Walker metric given in equation 7.22. Note that in Ryden,  $d\Omega^2$  is a shorthand for  $d\theta^2 + (\sin\theta)^2 d\phi^2$ .
2. Ryden problem 7.8. Hints for the second part of this problem (i.e. derivation of equation 7.54): 1. you might find the discussion on intensity  $J$  at the beginning of Chapter 2 useful, but you should also keep in mind that equation 2.2 for instance assumes Minkowski space, which is not what we have here; 2. the problem tells you that  $n_0$  is the number density of standard candles today, and that the candles are neither created nor destroyed as you go backward (or forward) in time – you should think carefully what this means for the proper number density versus comoving number density (one stays constant but the other changes with time).