

Astronomy 2115

Fall 2023

Homework #10

Due Tuesday, Nov 21 in class

For full credit you must write your solutions neatly and include all work. Do not forget the units.

- 1) Calculate the Jeans mass for a molecular cloud (all H_2) with density 300 particles/cubic centimeter and temperature of 10 K. What other physical conditions might prevent stars from forming with this mass?
- 2) Calculate the frequency (in GHz) of maximum emission for the cosmic microwave background observed today with a temperature of 2.73 K.
- 3) What is likely to happen to the size of the universe in the next 13 billion years? Will it less than double, exactly double, or more than double?
- 4) What is cosmic dawn? How old (in years) was the universe when it happened?
- 5) Name four problems with the Big Bang model.
- 6) How does Inflation solve these four problems with the Big Bang model?
- 7) What is the Baryon Asymmetry problem?
- 8) Why were only the four lightest chemical elements produced during the early universe? Why couldn't He fuse to make Carbon?
- 9) There could be other background radiation fields besides the microwave background. What might be the origin for a neutrino background? X-ray background? Low frequency radio background?
- 10) What is the temperature of the microwave background at $z=5$? How old is the universe at $z=5$?