ASTR 1040 RECITATION 4

9/19/2023

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LOGISTICS

Homework due Thursday – last ~15 min of recitation will be reserved for questions.

Observing report due now if you came last week, next observing session is 10/10

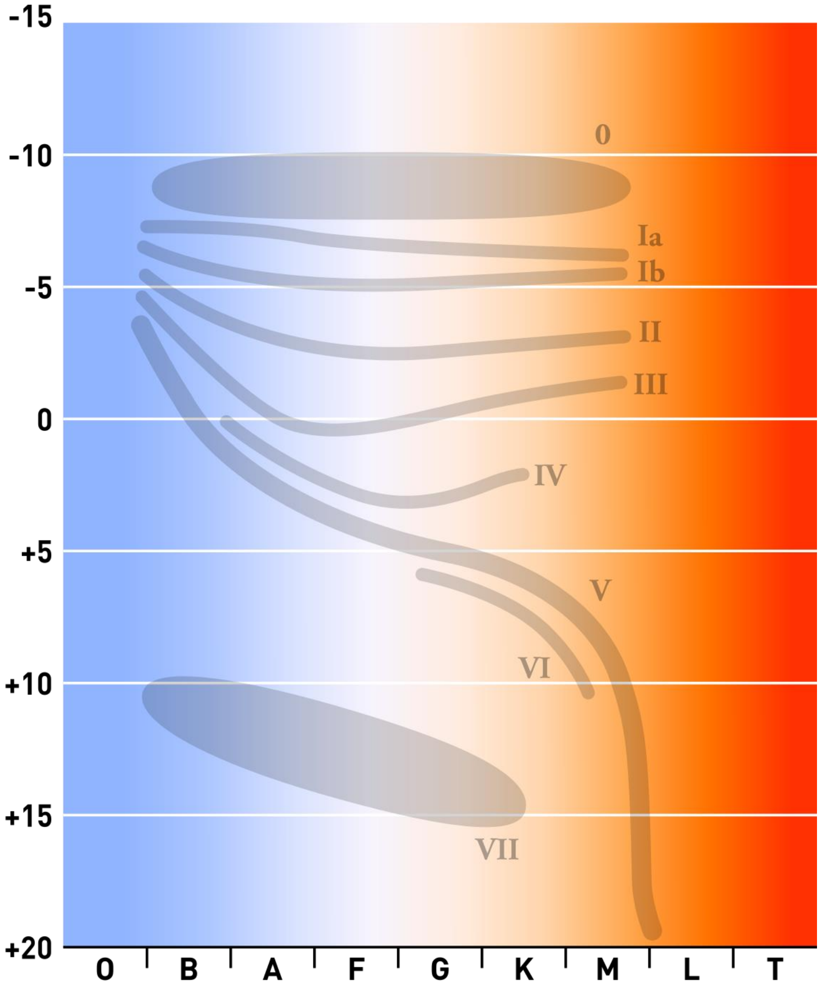
- The picture got deleted so turn it in without it ☹

I will be gone 9/21 - 9/30, and won't be able to check or respond to emails during that time.

- This means you should look at PS2 and PS3 and ask any questions you have now!!!

REVIEW: MAGNITUDES AND STELLAR CLASSIFICATION

- What is the Sun's spectral designation?
- Which has a brighter apparent magnitude – the Sun or Betelgeuse?
- Which has a brighter absolute magnitude – the sun or Betelgeuse?
- Which kind of main sequence stars are most massive? Least massive? Most luminous? Least luminous?
- Why are red giant stars so luminous?



PRACTICE PROBLEM 1: YOUR WEIGHT ON A WHITE DWARF

Say you try to make first footfall on a white dwarf, but your co-pilot warns you the gravity could be pretty strong and you should do a quick calculation first to make sure you won't get crushed to death. The white dwarf is roughly the radius of the Earth (6 x 10^6 m) and the mass of the Sun (2 x 10^{30} kg). Use Newton's law of gravitation to calculate your weight in Newtons, then convert this to a more familiar unit by recalling that one Newton is roughly 0.225 Earth pounds of force.

$$G \approx 6.67 \times 10^{-11} \left[\frac{\mathrm{m}^3}{\mathrm{kg\ s}^2}\right]$$

Big mass

Little mass

Gravitational constant

$$F = \frac{GMm}{r^2}$$

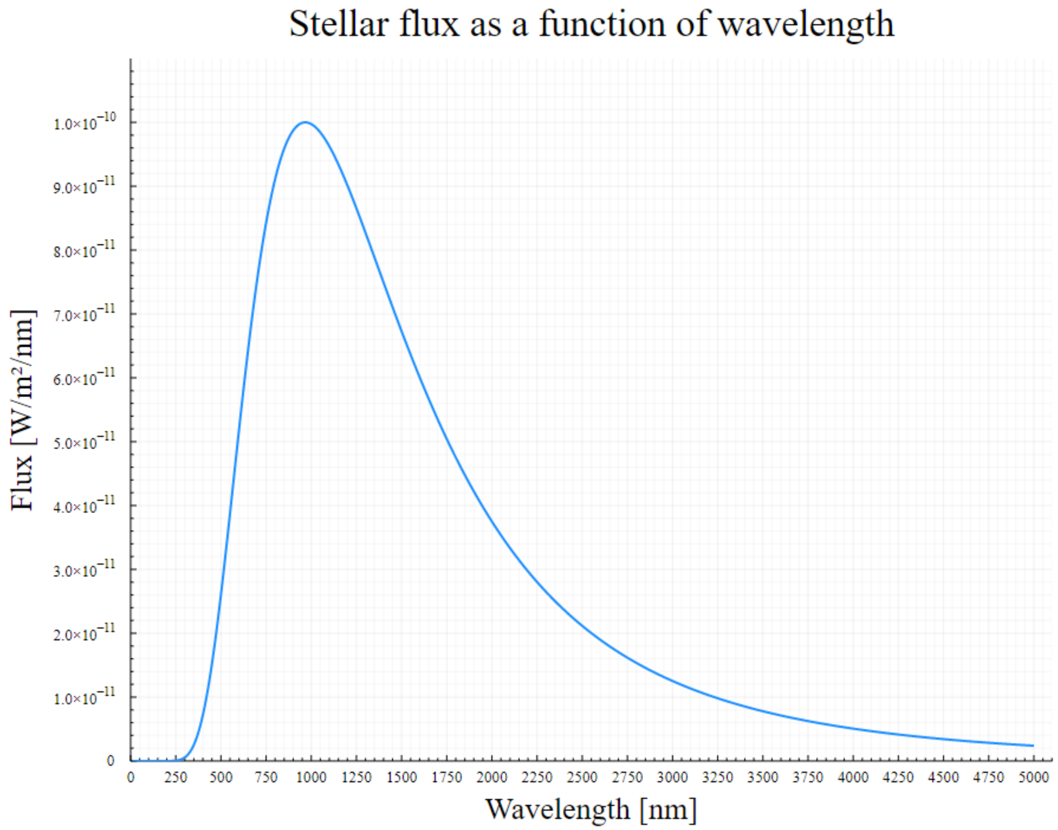
Distance between M and m

Now set up a ratio – how much more do you weigh comparatively to yourself on Earth? Is it safe for you to land? To do the ratio you can use either Newton's second law ($F = ma$, with $a = 9.81\frac{m}{s^2}$) or use the mass of the Earth, which is about 6 x 10^{24} kg.

PRACTICE PROBLEM 2: DERIVING THE PARSEC

1. Draw a triangle demonstrating how parallax measurements work from Earth to a distant star
2. Label the interior angle α and the sides their corresponding distances. Which one do we know?
3. Suppose $\alpha = 1$ arcsecond. Determine the distance to the star two ways, one using the small angle approximation ($\sin\alpha \approx \tan\alpha \approx \alpha$ for $\alpha[\mathrm{rad}] \ll 1$) and once with actual trigonometry.
    1. How different are your answers?
    2. Does it matter which side of the triangle you call the distance to the star?
    3. Convert your answer to ly (you should get 3.26).

PRACTICE PROBLEM 3: DERIVING LUMINOSITY



Suppose the star from the previous problem has a measured spectrum that looks like this. What is the star's:

1. Temperature?
2. Luminosity?

Hint: you'll need to use a very crude approximation for an integral (think about units).

OPEN DISCUSSION / HOMEWORK

Some example questions for your consideration:

- What are you still confused about you'd like to talk through again?
- What esoteric / random thought experiments do you want to trip me up on?
- What homework questions do you have?
- What logistics questions / concerns do you have?
- What would you like to see in recitations?
- + whatever else you want to talk about!

Work with each other on your homework and ask for help!