HOMEWORK #2 (due start of class Jan. 22)

LEARNING GOALS for this assignment:

1. To understand the concepts of parallax, angular diameter, and the small angle equation.
2. To apply this understanding via practical situations in modern astronomy.

TO RECEIVE FULL CREDIT:

1. Staple multiple pages and identify yourself by Star Name (worth 5 points!).
2. You must **show how** you derived your answer by writing all the logical steps that led you to it. Follow the format of the "Homework Example" on our Web site.
3. All sentence responses must be typewritten and in complete sentences. You may handwrite any arithmetic. Use good English grammar.
4. **If you work more than three hours on this assignment, you should stop, record your work here, and contact Dr. McCarthy or Mr. Hammer (our Teaching Assistant) for help.**

Part I: Read sections 1.1 through 1.6 (Ryden and Peterson's book) to review this week's concepts and to prepare for next week's classes.

Part II: Solve any three of the following problems concerning the measurements of distance (parallax) and angles (arcseconds).

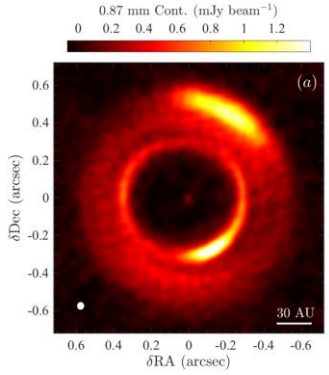
1. The number of arcseconds per radian is identical to the number of AU per parsec!

a. Calculate the number of arcseconds per radian to six significant digits.

b. Using the small angle approximation for parallax angle, calculate the number of AU per parsec (to six significant digits). Compare to your answer in Part (a) above. Does this answer make sense: Why or why not?

2. The black hole (Sgr A*) at the center of our Milky Way galaxy is predicted to have an event horizon of diameter 0.16 AU. What is the corresponding angular diameter as seen from Earth at a distance of ~8 kpc?

3. A recent image (below) from the ALMA Observatory shows intriguing features in the protoplanetary disk of dusty material around the young star MWC 758. These features may be caused by planets in the process of formation. The "resolution" of this image is 40 milliarcsec (40 mas), so the image can reveal details as small 40 mas in angular diameter. If MWC 758 is located 160 pc from Earth, what physical distance (in AU) corresponds to this angular diameter?



4. Europe's Gaia spacecraft is measuring the positions of about one billion stars in our Milky Way galaxy. Gaia can measure parallax angles as small as 7 microarcsec (7 μas).

The spacecraft is located at Earth's Lagrange point (L2), i.e., a distance of ~1.5 million km from Earth in a direction opposite the Sun.

a. What distance (in kpc and light-years) corresponds to this parallax angle?

b. Express this distance as a percentage of the diameter of our galaxy (~10^5 light-years).