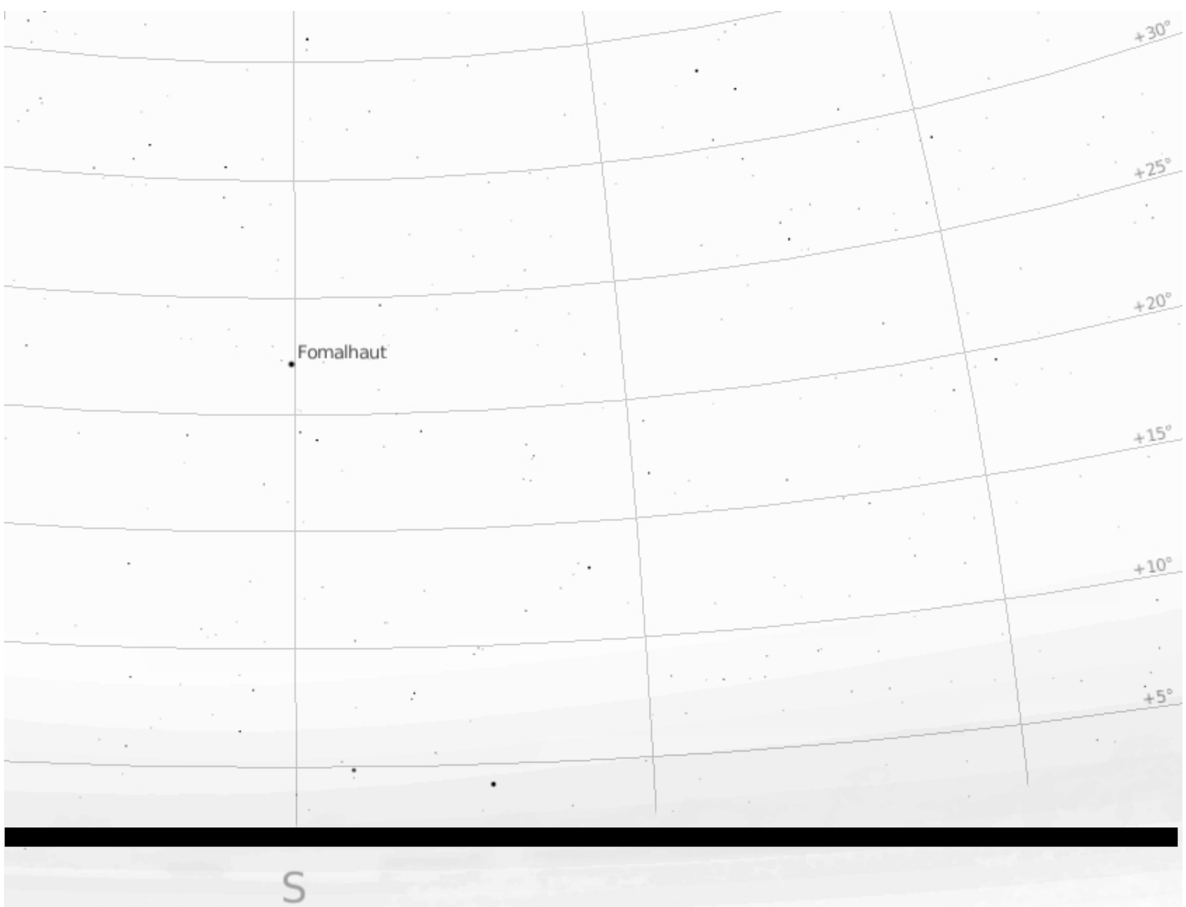
Names: ____

Measuring the Earth with the Stars

In our textbook, *The Known Universe*, we learn that you can use the stars to prove that the Earth is round, and to figure out how big it is.

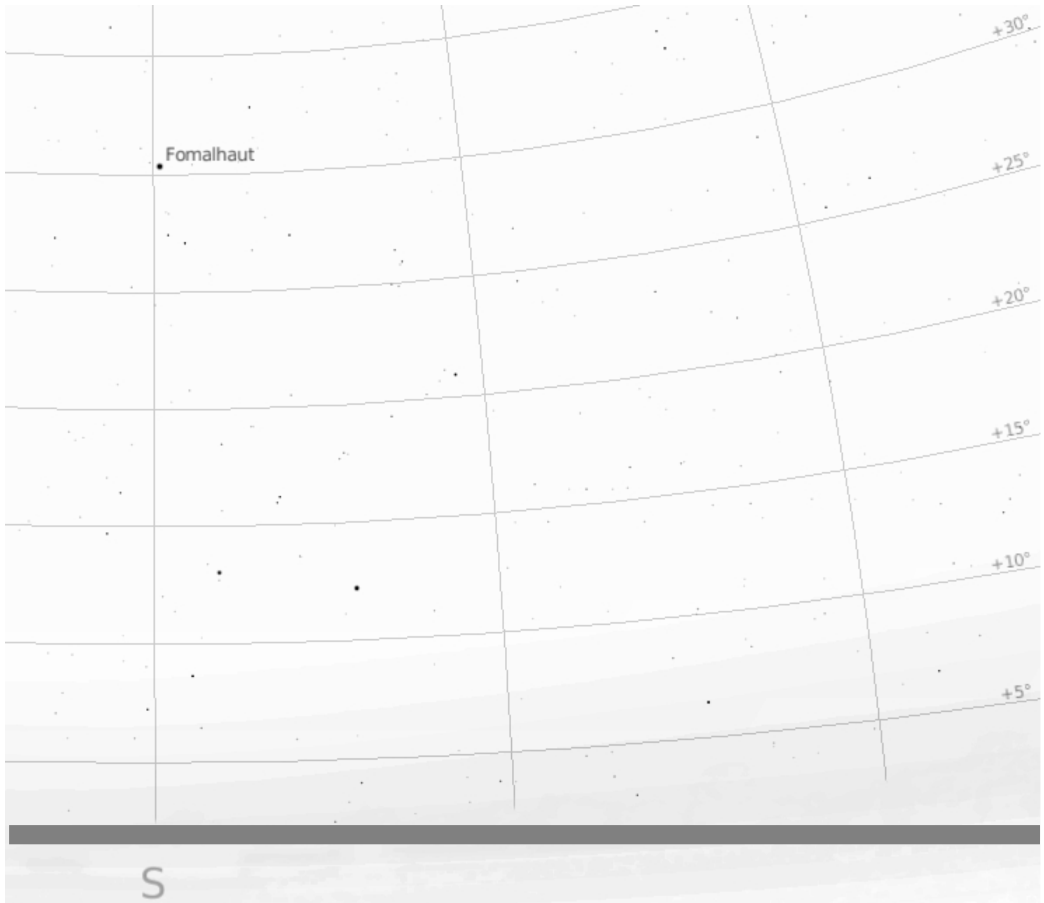
In this exercise we will use the stars to calculate the size of the Earth. Below is a simulation of what the late-summer sky looks like in Louisville if you look towards the south after midnight. There are many dim stars, and one bright star, Fomalhaut. Also shown in the simulation is a grid for determining how high (in degrees) above the horizon a star is.

LOUISVILLE, KENTUCKY (August 30, 1 AM)



Suppose you were vacationing on the gulf coast in Panama City, Florida instead of being in Louisville. The sky would look a little different in Panama City on that night.

PANAMA CITY, FLORIDA (August 30, 1 AM)



On the other hand, if you were vacationing up on Lake Michigan, the sky would also look different (next page).

What is altitude of Fomalhaut above the southern horizon

in Louisville? ____________________________

*in Panama City?*____________________________

*in Traverse City?*__________________________

TRAVERSE CITY, MICHIGAN (August 30, 1 AM)

*Now, going from Louisville to Panama City, by how much does Fomalhaut's altitude change?*________________________________

*Panama City is how many miles south of Louisville (use the map at the end of the assignment)?*_____________________________

According to the discussion of your textbook, *The Known Universe*, as you move from Louisville to Panama City, you move a certain distance around the Earth -- a distance that can be measured in both miles and degrees. The miles you read from the map (or measure it with the odometer of your car if you were to actually drive it). The degrees are reflected in the changes in the stars. We know that all the way around the Earth is 360 degrees -- a full circle is 360 degrees. What we don't know, but are about to find out, is how many miles we would need to travel to go all the way around the Earth. The distance moved around the Earth is the same as Fomalhaut's altitude change (in degrees) and the miles you measured, so just record those values again here.

*Distance travelled in degrees (D):*_________________________

*Distance travelled in miles (M):*___________________________

So, how many D's are in a full circle?
(Divide 360 by D): _______________________________________

There must be that many M's in a full circle around the Earth. Multiply M by that value and you have the distance in miles around the Earth (the circumference).

*Circumference of the Earth (in miles) measured using Louisville and Panama City:*____

Now repeat using Louisville and Traverse City:

*Distance travelled in degrees (D):*_________________________

*Distance travelled in miles (M):*___________________________

So, how many D's are in a full circle?
(Divide 360 by D): _______________________________________

*Circumference of the Earth (in miles) measured using Louisville and Traverse City:*_______________________________________

Now repeat using Panama City and Traverse City:

*Distance travelled in degrees (D):*_________________________

*Distance travelled in miles (M):*___________________________

So, how many D's are in a full circle?
(Divide 360 by D): ____

*Circumference of the Earth (in miles) measured using Panama City and Traverse City:*_____________________________________

You got three values for the distance around the Earth (in miles). Take an average of those three (add them up and divide by three).

Average value you calculated for
*Circumference of the Earth (in miles):*_________________

The “true” value for the circumference of the Earth is 24,900 miles. How far off was your value (subtract one from the other)? This is your “error”.

Error: ____

Find this in terms of percentage of the true value. Take your error, divide by 24,900 and multiply by 100.

Error (as percentage): _______________________________________

If your error level is less than 10%, you've measured well. If it is less than 5%, you've measured very well! If you are off by more than 15%, you measurements are lousy -- go back and see where you goofed up and redo your calculations.

Thus anyone who can travel and measure the miles can measure the size of the Earth for themselves!

MAPS (from Google)