Module 1: You Are Here

Objectives/Key Points

Students will be able to:
1. Describe the Earth's location in the hierarchy of astronomical structures.
2. State what these structures consist of.
3. Use powers of ten notation to relate the size scales of different structures.

Unit Home

Any unit, very introductory – can be used to reinforce powers of ten notation.

Prerequisites

Teacher is assumed to have covered basic scientific notation (powers of ten) previously.

Time

30 minutes including handing out materials

Materials

Maps from http://www.atlasoftheuniverse.com/negative.html, each printed out on one page for each student, omitting the first two (start from Orion Arm).

Likewise each student gets two maps from http://www.projectrho.com/rocket/rocket3aj.html (search the page for "Henbest" to find images of maps from Henbest's Guide to the Galaxy)

Sticking Points

1. Students usually assume "light years" (LY) is a unit of time rather than distance. In this lesson, this confusion comes up only because of the units printed on the maps, so the teacher should briefly clarify the units and move on. (Module 2 revisits light years more thoroughly.)

2. The names "Local Bubble" and "Local Group" are often reversed by students – a little extra repetition can be helpful.

Pre-Lesson

None.

Main Lesson

1. Each student gets a set of astronomical maps and makes an individual blind attempt to order the maps from smallest to largest. If the maps will be used for multiple classes, teacher should re-randomize the map order before each class. Teacher should clarify that the unit "ly" or "LY"

or “light years” written on the maps is a unit of distance like m or km but much larger (n.b., light years are not further discussed in this lesson). Also stress that points in some maps are stars and points in other maps are galaxies.

2. As a class, watch the video at
http://micro.magnet.fsu.edu/primer/java/scienceopticsu/powersof10/

Teacher should slow down to manual, discuss the names of objects and what they’re made of, and how large the box is (small red box is $1/10^{th}$ edge-length, $1/100^{th}$ area of frame). Tell kids these are artists’ renderings! Stop at the frame of the Moon’s orbit to clarify what it is. Stop at the 10^{18} m (100 LY) picture to point out that the Solar System is in a clear bubble between denser gas clouds. This clear bubble helps make astronomy possible!

Definitely name/explain:
Earth: made of rock, water, air, etc.
Solar System: made of planets, star (Sun), etc.; Earth not at center
Local Bubble: made of thin gas surrounded by thick gas; point out nearby stars (Polaris, Betelgeuse, Arcturus, Vega)
Milky Way: made of gas and stars, Solar System in spiral arm
Local Group: Milky Way and Andromeda Galaxy pair, satellites
Universe: large-scale clusters of galaxies

3. What am I? (Teacher should read questions or put them on an overhead; have students write down their answers and hold them up before the teacher answers. Works well as a matching lists question.)

- I am located in the Local Group along with the Andromeda Galaxy. [A: the Milky Way]
- I am made of thin gas surrounded by thick gas, and I contain several well-known stars. [A: the Local Bubble]
- I am made of the Sun and planets like Mars and Jupiter. [A: the Solar System]
- I am made of stars and gas arranged in big spiral arms. [A: the Milky Way]
- I contain everything. [A: the Universe]

4.  Have students work in pairs to reorder the astronomical maps and label them. Discuss and correct answers with class.

Enrichment

Discuss why the universe offers one of the best reasons to use scientific notation. (The Universe is really big!)

The Milky Way Galaxy has diameter 10^{18} m and the Solar System has diameter 10^{13} m. Using powers of ten, how many times larger is the Milky Way than the Solar System? Define two possible meanings of “larger” and answer the question using both, separately. If you have a square map of the Milky Way and a square picture of the Solar System on the same scale, how many Solar System pictures would you need to cover the Milky Way map?

Post-Lesson

None.