

Scales in the Universe: AST301 — Prof Steven Finkelstein

Name: _____

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Instructions: Work in groups of four. Discuss and come to a consensus **before** writing down any answers. We will do Question 1 as a class. For questions 2 and 3, you can move around the classroom or outside.

1) **The Earth-Moon system:** Imagine that one of the 9” paper plates is the Earth. We’re going to pretend that the other plate is the Moon, though in reality, that plate should be ~4X smaller.

- a) The diameter of the Earth is 12,742 kilometers (km). If we imagine the 9” plate represents the Earth, what is our scale in units of kilometers per inch?
- b) On this scale, how far away do you think the Earth and Moon should be (in inches, feet, or paper plates)? Discuss amongst your group, and write down your guess before moving on.
- c) Using the true Earth-Moon distance (remind me to tell you!), how far away are the Earth and Moon truly on this scale? Discuss the difference between this answer and your original guess amongst your group.

2) **The Milky Way and Andromeda:** Now, imagine that one paper plate is the Milky Way galaxy. On this scale, the other paper plate is approximately the size of the Andromeda galaxy (also known as M31).

- a) The diameter of the Milky Way is 100,000 light years. If we imagine the 9” plate represents the Milky Way, what is our scale in units of light years per inch?
- b) On this scale, how far away do you think the Milky Way and Andromeda should be (in inches, feet, or paper plates)? Discuss amongst your group, and write down your guess before moving on.
- c) Using the true Milky Way-Andromeda distance (look at the back of this sheet near the words “Milky Way”, how far away are these two galaxies on this scale? **Walk out this distance.** Discuss the difference between this and your guess.

3) **The Sun and Alpha Centauri.** Now, imagine that one 9” paper plate is the Sun. On this scale, the other paper plate is approximately the size of Alpha Centauri, (one of) the closest stars to the Sun.

- a) The diameter of the Sun is 1,391,400 km. If we imagine the 9” plate represents the Sun, what is our scale in units of km per inch?
- b) On this scale, how far away do you think the Sun and Alpha Centauri should be (in inches, feet, or paper plates)? Discuss amongst your group, and write down your guess before moving on.
- c) Using the true Sun-Alpha Centauri distance (look at the back of this sheet near the words “Sun”, how far away are these two stars on this scale? **Walk out this distance.** Discuss the difference between this and your guess.
- d) What is more empty relative to the size of the object? The space between planets, between stars, or between galaxies?

SUN-ALPHA CENTAURI DISTANCE

4.1 x 10¹³ km

MILKY WAY - ANDROMEDA DISTANCE

2.5 million light years