

Chapter 17: Stellar vs. Galactic Separation

Student Worksheet

Objective:

Investigate the scaled separation between stars and compare it to the scaled separation between galaxies. Use this information to understand the possibility of collision for galaxies or collision for stars.

Engage:

If you place a soccer ball at one end of a field and another soccer ball at the other end of the field, how many soccer balls could you line up between them? Estimate your answer first; then calculate it, assuming the length of the soccer field is 100m and the diameter of a soccer ball is 0.22m.

Introduction:

In your astronomy education thus far, you have seen how large stars are. The Sun makes the planets of the solar system seem tiny, yet other stars can make the Sun seem just as small. Stars are huge. So are the distances between them. In this activity you will see how many stars could fit between the Sun and a few of its neighbors. For example, in Table 1 below, you will calculate the scaled distance between Sirius A and the Sun. That scaled distance is essentially telling you how many Sirius A's could fit between Sirius A and the Sun.

Your Task:

1. Use the data in Tables 1 and 2 below to calculate the scaled distances between stars and between galaxies.

Table 1 Distances between Stars

Star Name	Diameter (meters)	Distance from Sun (light years/converted to meters) (1 light year = $9.46 \times 10^{15} \text{m}$)	Scaled Distance (distance in meters/diameter in meters)
Antares	1.23×10^{12}	550	
Arcturus	3.58×10^{10}	37	
Sirius A	2.36×10^9	8.6	
Canopus	9.04×10^{10}	310	
Proxima Centauri	1.95×10^8	4.2	

Table 2 Distances between Galaxies

Galaxy Name	Diameter (light years)	Distance from Milky Way (light years)	Scaled Distance (distance/ diameter)
Andromeda, M31	125,000	2,500,000	
Small Magellanic Cloud	16,000	200,000	
Large Magellanic Cloud	31,000	165,000	
Sag DEG (Dwarf Elliptical Galaxy)	10,000	50,000	
Sag DIG (Dwarf Irregular Galaxy)	3,000	3,400,000	

Conclusion:

1. Looking at the separations between stars would you be able to model the scaled distance between stars using tennis balls to represent the stars?
2. Would it seem probable that stars collide? Why or why not?
3. Would it seem probable that galaxies collide? Why or why not?
4. The Andromeda galaxy and the Milky Way are predicted to collide in 5 billion years. Astronomers do not expect any stars to collide when the two galaxies become one. Using the results you have found, explain why this makes sense.

Extend:

- What are some pieces of evidence for galaxy mergers? What are the results of galaxy mergers?
- Look into our neighbor Sag DEG. What has brought Sag DEG into the news lately?