Hands on Astronomy Activity 3

Topic: Constellations
Learning Objective: Making a 3D model of constellations and asterisms so that students can learn that the patterns that we see in the night sky are not actually as close together as they appear. While it looks like the stars in the Orion constellation and the Big Dipper asterism look like they fall in the same plane, some of the stars are much closer to us than the others. This lesson will help students understand the three-dimensional nature of space, as well as the fact that constellations and asterisms would look different if you looked at them from a different location in the Milky Way.

Alignment with NGSS Grades 3-5
Science and Engineering Practices
Developing and using Models 3-5

- Develop a diagram or simple physical prototype to convey an object, tool or process.

Crosscutting Concepts and Connections to Engineering, Technology, and Applications
Connections to the Nature of Science
Scientific Knowledge is Open to Revision in Light of New Evidence

- Science Explanations can change based on new evidence.

Materials:

- Copies of constellation photograph
- Copies of constellation charts
- Yard stick
- Steel washer
- Piece of corrugated cardboard
- Pony beads
- 1-meter long pieces of thick, black thread
- Scotch tape

Instructor Preparation

- Tape or glue constellation photographs to cardboard
- Punch holes through photo/cardboard backing at the position of each star • Cut thread into meter-long pieces

Detailed Description

- Introduction

    - Ask students if they have ever seen the constellation of Orion or the Big Dipper asterism in the night sky before
        - Talk about the terms “constellation” and “asterism”
        - Explain that there are 88 constellations in the sky that astronomers use to describe regions in space that are used to locate objects in the celestial sphere
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    - Ask the students if they think that the stars in the constellations and asterisms are all the same distance from Earth
- Procedure
    - Pass the lengths of thread through eight individual beads, looping the thread back through the bead so that it can slide along the thread
    - Pass the beaded threads through the holes in the Orion constellation, leaving one inch of thread at the back
    - Have the students tape the threads to the back of the cardboard
    - Bring all of the ends of the thread together and tie them to the washer at a length of 56 cm (22.05 in)
    - Have the students move the beads along the threads to certain distances from the washer based on the table seen below
        - Note that every 2.5 cm (0.98 in) is equal to 100 LY.
        - Have students look through the washer to ensure that the “stars” look like they do in the picture
        - Explain that the correct length will correspond to the focal length of the camera that took the picture of the constellation

Star Pattern	Star Name	Distance (LY)	Scaled Distance (IN)	Scaled Distance (CM)
Orion	Betelgeuse	640	6.4	16.3
	Meissa	1050	10.5	26.7
	Bellatrix	240	2.4	6.1
	Alnitak	800	8	20.3
	Alnilam	1340	13.4	34
	Mintaka	915	9.2	23.2
	Saiph	700	7	17.8
	Rigel	800	8	20.3
Big Dipper	Alkaid	101	1	2.5
	Mizar	78	0.8	2
	Alcor	81	0.8	2
	Alioth	81	0.8	2
	Megrez	81	0.8	2
	Phecda	84	0.8	2
	Merak	79	0.8	2
	Dubhe	124	1.2	3.1

- Once the beads are positioned, have one student hold the cardboard while another student looks through the washer
    - Point out that this is what the constellation of Orion looks like from Earth
- Have the student move to the side of the model to see that our perception of the positions of the stars, based on our location with relation to them leads us to think that they are in a plane, which they are not
    - Put up the picture of the side-view of Orion on the wall
- Point out that this is the nature of all of the stars in space. If we were to move to a different location in the Milky Way, the stars in the night sky would look completely different because we live in three-dimensional space
    - Ask students if Orion would look the same if they were on a planet that was orbiting Betelgeuse
    - Have students move the model around to look at the perspective from that star o If there is time remaining, create a model of the Big Dipper asterism to show that some stars travel in groups
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Conclusion

- Point out that while the stars in the constellation of Orion are at widely varying distances from us, most of the stars in the Big Dipper asterism turn out to be about the same distance from us. Why do the students think this is?
    - Answer: They are part of the Ursa Major Moving Group, whose central part is about 80 LY away from Earth. These stars were probably born together, therefore they are orbiting around the center of the Milky Way at roughly the same distance.
- Show video of the helical model of the Solar System to show them how our cosmological home travels through the Milky Way

Science Process Skills Used

Observation, conceptualization, modeling, measuring, visualizing

Safety Precautions

None