Life cycle of a massive star

ACTIVITY INSTRUCTIONS

> ⓘ **SAFETY NOTICE**
> Be sure to keep beads away from curious young mouths.

Suggested Age Range
Ages 8 and up

Activity Duration
5-10 minutes, depending on discussion time

Materials
- Colored pony beads: green, blue, yellow, red, orange, white, black, and more green
- Hole punch
- Cord or yarn
- Scissors
- Tape
- Webb Life Cycle bookmark (use cardstock if available)

  https://www.jwst.nasa.gov/education/JWSTLifeCyclesBookmark.pdf

Setting
Indoors, or outdoors if it isn't windy

Objective
Model the life cycle of a massive star by using beads to represent the different stages of the star's life.

Background on the Webb Telescope
NASA's James Webb Space Telescope is designed to see light in the infrared part of the spectrum. Spanning the size of a tennis court and standing three stories tall, Webb is the largest observatory ever sent into space. From its orbit some one and a half million kilometers from Earth—about four times the Earth-Moon distance—Webb can study many things, including the life cycle of stars. In this activity, participants make a visual representation of the life cycle of a massive star (a star more massive than the Sun) by associating different colored pony beads to different stages of stellar life.

Preparation
Depending on your participants' ages, you may wish to do some steps yourself in advance, such as punching the holes or cutting the cord/yarn.

Procedure
1. Invite your participant to describe a life cycle that is familiar to them.
2. Discuss how a star also goes through a life cycle, and that the star's life cycle depends on its mass (how much stuff the star is made of). Explain that the James Webb Space Telescope can help us study the life cycle of stars.
3. Punch a hole near the end of the Webb Life Cycle bookmark.
4. Cut six to eight inches of cord or yarn. Thread it through the hole and tie it to the end of the bookmark.
5. Tape the end of the cord or yarn for easy threading of the beads.
6. Explain that your participant will be modeling the stages of the life cycle of a massive star, a star more massive than the Sun.

   (**Note**: A star like the Sun will eventually become a "white dwarf"; it will not go supernova or become a neutron star or black hole.)

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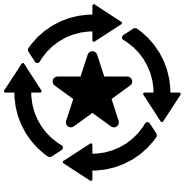

Stages in the life cycle of a massive star

STEP 1 - GREEN
A cloud of gas and dust collapses due to gravity, creating a protostar.

STEP 2 - BLUE
Gravitational energy powers the young star until...

STEP 3 - YELLOW
...nuclear fusion occurs. The main sequence star may live millions or even billions of years.

STEP 4 - RED
The star expands into a red giant when the star's hydrogen level drops.

STEP 5 - ORANGE
Different fusion processes occur. The star expands, cools, and loses mass each time.

STEP 6 - WHITE
Fusion stops and a supernova explosion occurs. Most of the star is blown away.

STEP 7 - BLACK
Depending on the original star's mass, either a black hole or neutron star remains.

STEP 8 - GREEN
The material shed during the star's life joins new gas clouds, and new stars are formed.

Procedure (continued)

7. Invite your participant to string beads by color, consulting their bookmark for the correct order of beads.
8. Check for correct order before tying a final knot.

More Resources

Learn more about the life cycles of stars:
https://imagine.gsfc.nasa.gov/educators/lifecycles/stars.html

Learn more about NASA's James Webb Space Telescope:
https://jwst.nasa.gov/

Credit

Adapted from the Life Cycle of a Massive Star activity at:
https://www.jwst.nasa.gov/content/forEducators/informal.html

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