SN EDUCATOR GUIDE

November 11, 2017

Neutron Star Crash Seen for First Time

Cross-Curricular Discussion: Q

Directions: The following list of discussion questions is provided to help you take notes, brainstorm ideas and test your thinking in order to be more actively engaged in class discussions related to this article. All questions in this section are related to topics covered in "Neutron star crash seen for first time."

CHEMICAL SCIENCES

Discussion questions:

1. How can different wavelengths of light be separated to study the spectrum (spectroscopy) of an object in space?

2. How can spectroscopy be used to determine the chemical composition of stars, colliding neutron stars, nebulae (gas clouds) or other objects in space?

Extension prompts:

3. The curve of binding energy shows how tightly bound the nucleons (protons and neutrons) are within a nucleus, depending on the mass of the nucleus. Based on a binding energy curve, similar to the one titled "Fission and fusion can yield energy" found on the HyperPhysics page hosted by Georgia State University, what element appears to have the most stable nucleus? How do you know from the graph?

4. Fusion reactions join small nuclei together to create larger nuclei. Based on that graph, would fusion reactions of nuclei that result in nuclei that are less massive than iron consume or release net energy?

5. Based on that graph, would fusion reactions that result in nuclei that are more massive than iron consume or release net energy?

6. For a given mass of fuel, which releases more energy — fusion of very light elements to form a stable nuclei, or fission of a very heavy element to form stable nuclei? Use the graph.

PHYSICAL SCIENCES

Discussion questions:

1. How does a star form?

2. How does a star live?

3. How does a star die?

Extension prompts:

4. What is a Hertzsprung-Russell diagram?

ENGINEERING AND EXPERIMENTAL DESIGN

Discussion questions:

1. How long did it take light and gravitational waves to travel from the neutron star collision to earth? How long ago did the collision actually happen?

2. The New Horizons probe that flew by Pluto in 2015 is traveling away from our solar system at approximately 52,000 kilometers per hour. What fraction of light speed is that? If New Horizons were traveling toward NGC 4993 and kept that same velocity, how long would it take to reach from Earth whatever is left of the neutron star collision?

Extension prompts:

3. What sorts of things could we monitor or learn from satellites with similar sensors that are pointed inward toward Earth instead of outward toward space?

4. How might the gravitational wave detectors be improved?