Grades: 9-12

Nova, "Black Hole Apocalypse Pt. 1"

Join astrophysicist and novelist Janna Levin on a mind-blowing voyage to the frontiers of black hole science, which is shining new light on the most powerful and mysterious objects in the universe. Black Holes are the most enigmatic and exotic objects in the universe. They're also the most powerful, with gravity so strong it can actually trap light. And they're destructive. Anything that falls into them vanishes… gone forever. But now, astrophysicists are realizing that black holes may be essential to understanding how our universe unfolded – possibly leading to life on Earth.

After watching this episode, choose from the following questions and/or tasks to extend your learning

Question Box 1

- What is the central message in this program? Explain?
- What are the program's supporting claims that support the central message?
- What is the author trying to say through the TV program? What from the show makes you believe this?
- What evidence does the TV show director give to support his or her central idea?
- What is this program "saying"? Cite evidence to support your analysis.

Question Box 2

- If someone else were looking at this program, what might they learn?
- What is one thing I would like to add to this topic?
- What would you change about this program?
- If a part 2 of this program was created, what would you like them to focus on?
- What would you like to research for extra credit? Why?
- What is an astrophysicist?
- What is black hole science? Why are they such a mystery?
- What exactly is a black hole and why is it known as the most powerful force, with gravity so strong it can actually trap light?
- Anything that falls into them vanishes… gone forever. Why is this?
- How is this black hole science shining new light on the most powerful and mysterious objects in the universe?
- Astrophysicists are realizing that black holes may be essential to understanding how our universe unfolded – possibly leading to life on Earth. What details from the program support this hypothesis?

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Box 3 (Tasks)

- The supermassive black hole at the core of supergiant elliptical galaxy Messier 87 has a mass that is approximately 7 billion times the mass of the sun, which is approximately $2x10^{30}$ kg. What is the mass of the black hole?
- What objects can you compare where one object is 7 times the other? How does that compare with 7 billion? Use mathematics in your explanation.
- According to the video...Discuss the tie to Black Holes and Life.
- Make a model of a Black Hole and diagram its interaction with light.

Box 4 (Enrichment)

- Watch the 2009 Star Trek movie. How is the portrayal of black holes scientifically accurate/inaccurate from the science in the program "Black Hole Apocalypse" (Part 1)
- Research and describe a Black Hole in language that an elementary student can understand.
- Gravity is an incredibly weak force. Discuss with evidence the relationship between gravitational force and the size of a black hole
- Describe with evidence the Event Horizon of a Black Hole.

Box 5 (Extend/Real-Life)

- Discuss the evidence why the space anomalies are called "Black" holes
- Explain a "Black Hole Singularity" using a model and in layman's terms.
- Nasa has a lot of great information on Black Holes. Consider the questions below while reviewing this website: https://science.nasa.gov/astrophysics/focus-areas/black-holes
    1. What classes have you taken or will take in high school that would help prepare you for a career in astronomy?
    2. The information on this webpage required many people with varied backgrounds. Brainstorm a list of careers that would have been required to discover, collect, and publish all of that information.
    3. Were any of the careers you listed outside of science? Look over this list: http://www.jobsforastronomers.com/careers and see how many of these careers you listed.
    4. Would you consider a career in astronomy? Why or why not? If so, what career would you select?