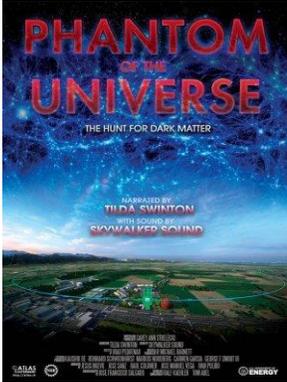


KIDSPACE
A CHILDREN'S EXPLORATION CENTER

Educator Viewing Guide



Phantom of the Universe (2017)

27 minutes

Phantom of the Universe showcases an exciting exploration of dark matter, from the Big Bang to its anticipated discovery at the Large Hadron Collider.

The show reveals the first hints of its existence through the eyes of Fritz Zwicky, the scientist who coined the term "dark matter." It describes the astral choreography witnessed by Vera Rubin in the Andromeda galaxy and then plummets deep underground to see the most sensitive dark matter detector on Earth, housed in a former gold mine.

From there, it journeys across space and time to the Large Hadron Collider at CERN, speeding alongside particles before they collide in visually stunning explosions of light and sound, while learning how scientists around the world are collaborating to track down the constituents of dark matter.

Topics covered:

Astronomy, dark matter, particle physics

Interdisciplinary connections: history of science

Key Terms and Concepts:

Atoms, Dark Matter, Gravity, Mass, Momentum, Newton's Law of Gravitation, Particles, Protons, Supersymmetry, Quarks

Combine with these KidSpace Activities:

Ballistics Lab

Take aim with space-themed ball blasters, jump, and climb while exploring science concepts: forces, gravity, resistance, energy, and more.

Magnetic Lab

Investigate the push and pull forces of magnetism while guiding the unique material, Ferrofluid, a nanometer-sized particle that acts like a magnetic solid and liquid.

PlaySpace!

Science begins with imagination. The space-themed playground offers many opportunities for space-themed play, space-related discoveries, and demonstrations of science concepts: gravity, friction, force, laws of motion, and more.



Learning Resources and Activities:

Create learning units designed around a visit to KidSpace! These web resources and activities are designed to illustrate concepts and ideas presented in the show. Many of these can be adapted to various age groups.

Phantom of the Universe Educator's Guide; PhantomOfTheUniverse.com

This educator's guide provides teaching resources for all levels. Includes background information, discussion questions, links to additional resources, glossary, and national science standards.

http://phantomoftheuniverse.com/media/protected/Phantom_of_the_Universe_Ed_Guide.pdf

Educational Resources for Dark Matter Day; Interactions Collaborations

Dark Matter Day is celebrated on October 31, but these resources and activities can be done any time of year. Includes links to several activities about dark matter.

<https://www.darkmatterday.com/educational-resources-dark-matter-day/>

Dark Matter Possibilities; NASA Goddard Space Flight Center

This site provides directions, student worksheet, and links to resources for a research project about dark matter. Includes assessment rubric.

https://imagine.gsfc.nasa.gov/educators/galaxies/imagine/act_dark_matter.html

Dark Matter: Probing What You Can't See; Sonoma State University

This resource contains background information and activities designed to illustrate searching for dark matter. Includes activity lab sheet where participants investigate "hidden matter" between paper plates.

https://universe.sonoma.edu/activities/dark_matter.html

CERNland: An interactive website for kids; CERN

This "virtual theme park" contains games, multimedia applications, and videos designed to inspire children (7-12) with physics. Interactive website for children to learn about particle-physics, science news, atoms, and more. Available in multiple languages.

<http://www.cernland.net>

Exploring the Universe: Objects in Motion; NISE Network

This resource contains all downloads needed for participants to explore the complex and predictable ways objects in the universe interact with each other. Includes learning goals and videos (Spanish and English available).

<http://www.nisenet.org/catalog/exploring-universe-objects-motion-2018>

Exploring Magnetic Fields; American Association for the Advancement of Science (AAAS)

This site contains lesson plans and directions for two activities designed to explore magnetic fields. Includes material list, directions, student worksheets, assessment and extensions.

<http://sciencenetlinks.com/lessons/exploring-magnetic-fields/>



Comprehension Questions:

Help learners process the concepts and ideas presented in the show with these questions.

1. What is dark matter? How do scientists know it exists? Discuss gravity, mass, and force.
2. How do scientists make discoveries?
3. What are some scientific methods used to understand dark matter?
4. What did you learn from the show that is new to you?
5. What additional information would you like to know about dark matter and particle physics?

Further Research and Discussion

Based on questions and interests of learners and utilizing the Phantom of the Universe Educator's Guide, learners can engage in additional research on topics related to astronomy, dark matter, and/or particle physics. Encourage learners to search for recent discoveries and share these with others.

http://phantomoftheuniverse.com/media/protected/Phantom_of_the_Universe_Ed_Guide.pdf

This show covers content that addresses Colorado Academic Standard in Science (Physical Science and Earth Systems Science). See Planetarium Show Academic Standard Chart for details by grade.