

Into the Black Hole 3D

Teaching the Black Hole through 3D simulation

Lesson

Teaching the Black Hole through 3D simulation

Objectives

1) Students will gain a basic understanding of the Black Hole through 3D simulation and visualization

2) Students will gain a deeper understanding of the components of a Black Hole and how it functions

Activity

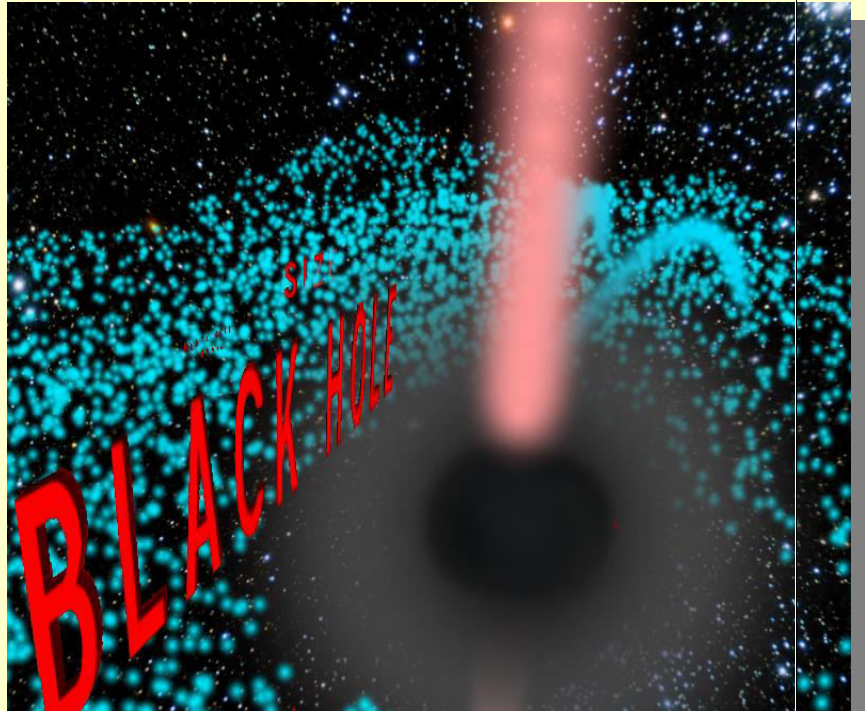
Students travel across a Black Hole in real-time 3D, helping them to visualize and understand its structure and gravitational power

Materials

Black Hole3D Homepage

(click or cut and paste URL into browser)

<http://www.sunrisevr.com/blackholes3d>



3D Simulation and Investigation

3D simulations are designed to make subject matter more engaging to today's technology-savvy kids, and help them bridge the gap between the "concrete" world and the abstract world of concepts. When students experience complex subject matter in real-time 3D it becomes clearer. Students learn best when they are actively immersed in subject matter from a variety of different viewpoints; 3D simulation is designed to help students visualize difficult ideas and objects through investigation at any scale (atomic, cellular, planetary, conceptual, etc), and doing things that would normally be impossible.

Required Technology

- PC/Tablet

Optional Technology

- Projector
- Multiple Computers
- Internet Connection

Required Technology

- PC/Tablet
- Small Group Instruction

Optional Technology

- Staging** Projector
 Check computer/Tablet for Internet access if needed
 • Internet Connection

Grouping

- Large
- Small

Staging

Check computer needed

Procedure

- 1) Access program
- 2) Pick a lead student navigator to control movement through the Black Hole
- 3) Pick a lead student reader to read information about the Black Hole as it appears on-screen
- 4) Begin the lesson by asking students what they already know about the Black Hole; write responses on the board
- 5) Review basic facts about the Black Hole including:
 - Black Holes are among the most mysterious objects in the universe
 - A Black Hole is a place with gravity so intense that nothing, not even light, can escape
- 6) Start traveling through the program, facilitate discussion by asking students where the class should go.
- 7) Use the 3D simulation as a visual aid; explain information as needed
- 8) Have students pay special attention to:
 - Location of the Singularity
 - Many black holes exist in binary star systems
 - The different types of event horizons
- 9) Have a final wrap-up with students with a question and answer period about Black Holes. Ask them how they work, and what are the important components of a Black Hole

Optional Activity: 3D Scavenger Hunt + Discussion

Have students find a particular part of Black Hole, such as the singularity. If students are on multiple computers, have them “race” to a part of the Black Hole the teacher wishes to highlight. Once students find/arrive at the location, the teacher may commence discussion. Repeat in other areas of the simulation as desired to build understanding.

Homework/Review

Students may also access the program outside the classroom to supplement textbook questions

Functional Notes

- The program is available on multiple platforms
- If using the program online, please ensure the Unity3D Player is installed on the computer; through the Internet Explorer Browser; download the latest at <https://unity3d.com/webplayer>.
- If you see something in **red** you can probably click on it
- For ease of use you can go through most 3D objects, and even the ground
- The school library can request and access programs (free) at www.sunrisevr.com for off-line use via PC and Mac if there is no internet connection