

BLACK HOLES

Gravity's Relentless Pull

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Black Holes

- Most extreme objects in the Universe
 - Of considerable interest to the public
 - Large demand for information
- Many questions and misconceptions
 - “do they really exist?”
 - “giant vacuum cleaners?”
 - “danger to earth?”
- Excellent topic to teach concepts of basic physics
 - Observations, hypothesis testing, scientific method
 - Scale and content of the Universe
 - Light
 - Gravity

Resources

- Interactive, Multi-Media **web site** developed at STScI
<http://hubblesite.org/go/blackholes>
 - Top Prize & Physics Category winner Pirelli Awards
 - Finalist NSF Science & Engineering Visualization challenge
- **(Free) Kiosk Software** for Informal Education Institutions
<http://hubblesource.stsci.edu/exhibits/components/kiosk>
 - Honorary mention American Association of Museums MUSE Awards

Introductory Animation



But if you could take the Earth and squeeze it to the size of a marble
the gravity on the surface would be much greater



Finding the Invisible

Smallville Planetarium: *SPECIAL FEATURE*

BLACK HOLES: *Gravity's Relentless Pull*

Finding the Invisible The Voyage Up Close and Personal



YOUR FINDINGS

NO BLACK HOLE

- Moon
- Sun
- Planet**
- Binary star
- Red giant
- Planetary nebula
- Supernova remnant

STELLAR-MASS BLACK HOLE

- X-ray binary
- Extragalactic binaries

SUPERMASSIVE BLACK HOLE

- Milky Way center
- Spiral galaxy
- Elliptical galaxy
- Quasar

See the Sky in Different Ways

Telescopes can "see" different wavelengths of light, revealing a universe invisible to our unaided eye. Select a wavelength and scan the sky for black holes. Objects will be collected automatically in **YOUR FINDINGS**.

X-Ray



Visible Light



Radio Waves



OBJECT: Saturn (Planet)
DISTANCE: 890 million miles (1.3 lighthours)
BLACK HOLE? No

Sixth planet from the Sun, Saturn is the second largest planet after Jupiter. It is encircled by a beautiful system of very thin rings, made up of icy debris that orbits around the equator.

[Learn More](#)

Begin Your Voyage

More Instructions

[Start Over](#)

[Credits](#)

The Voyage

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Welcome to your interstellar spacecraft. To begin your journey to the black hole, you must first escape Earth's gravity. Please select a speed.

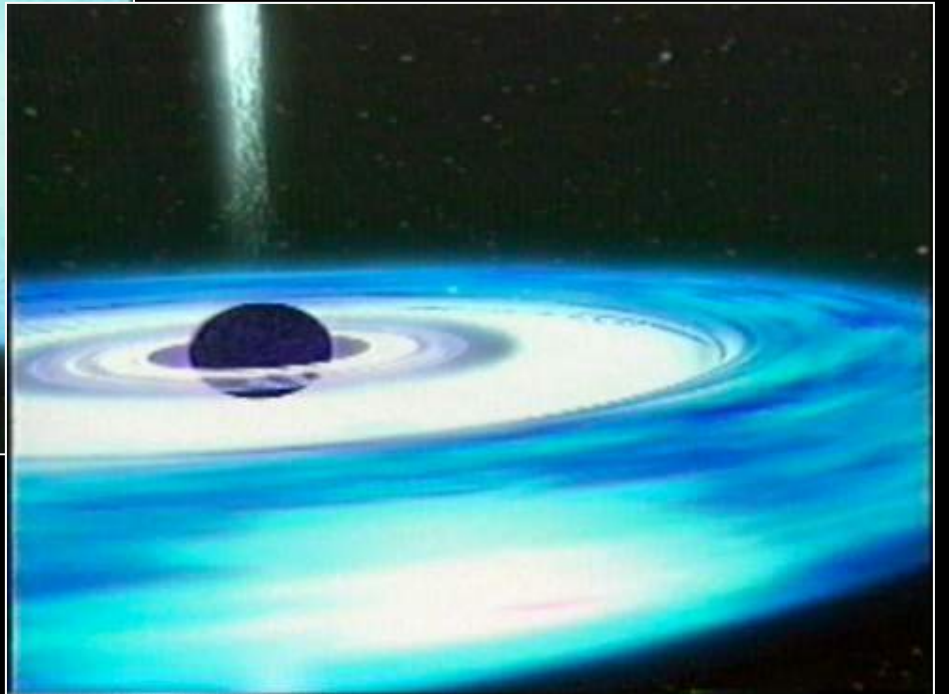
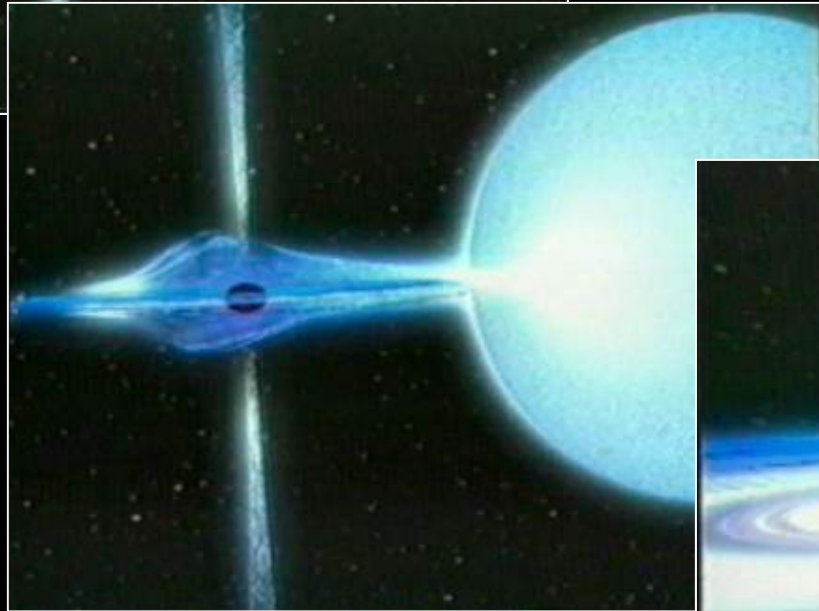
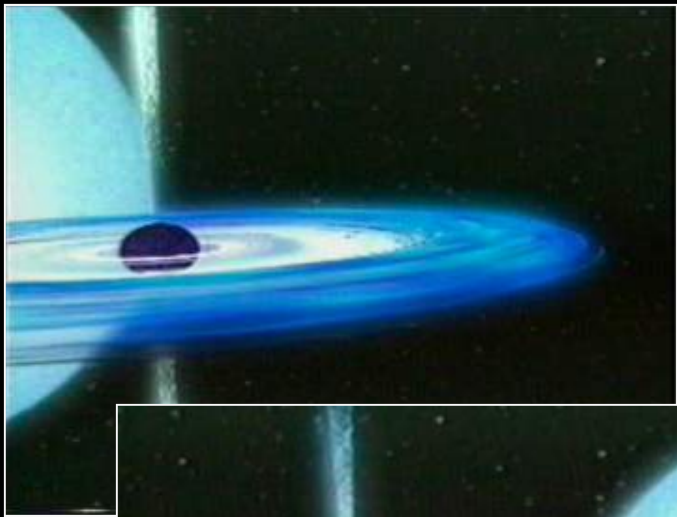
75 m.p.h.

717 m.p.h. (the speed of sound)

25,000 m.p.h.

Start Over

Credits



Up Close and Personal

HUBBLESITE Special Feature

BLACK HOLES: Gravity's Relentless Pull

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Questions

What is a black hole?

Do black holes obey the laws of gravity?

How big is a black hole?

What is inside a black hole?

What types of black holes are there?

What happens when black holes collide?

How many black holes are there?

How are black holes born?

How do black holes grow?

Do black holes live forever?

Experiments

Create a black hole

Orbit around a black hole

Find the mass of a black hole

Drop a clock into a black hole

Fall into a black hole

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Experiments

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Finding the Invisible The Voyage **Up Close and Personal**



Drop a Clock into a **BLACK HOLE**

Close

Instructions



Start Over Credits