

# Exploring Black Holes

Science Standards

## National Science Education Standards

<http://www.nap.edu/readingroom/books/nse/html/>

### Grades 9-12

#### Science as Inquiry

Students discover the properties of black holes based on their understanding of gravity and velocity. They also analyze astronomical images from the Hubble Space Telescope and Sloan Digital Sky Survey. Through an experiment, they define escape velocity. Then they extend this idea to a black hole, which is an object with an escape velocity equal to the speed of light. In the final activity, students become astronomers in charge of a new database of super-massive black holes. Their job is to evaluate new claims to decide if they are valid. They design an evaluation rubric and apply their new understanding of black holes to make their decisions. They also use real scientific data from Dr. Karl Gebhardt's black hole database.

#### Physical Science

Students apply concepts of force (gravity) and motion (velocity) to define a black hole by its unusual escape velocity – the speed of light.

#### History and Nature of Science

In order to evaluate super-massive black hole claims, students design an evaluation rubric. They also use real scientific data from Dr. Karl Gebhardt's black hole database.

## Texas Essential Knowledge and Skills

<http://www.tea.state.tx.us/rules/tac/chapter112/index.html>

### Integrated Physics and Chemistry, Physics

#### Scientific Inquiry

Students discover the properties of black holes based on their understanding of gravity and velocity. They also analyze astronomical images from the Hubble Space Telescope and Sloan Digital Sky Survey. Through an experiment, they define escape velocity. Then they extend this idea to a black hole, which is an object with an escape velocity equal to the speed of light. In the final activity, students become astronomers in charge of a new database of super-massive black holes. Their job is to evaluate new claims to decide if they are valid. They design an evaluation rubric and apply their new understanding of black holes to make their decisions. They also use real scientific data from Dr. Karl Gebhardt's black hole database.

#### Forces and Motion

Students apply concepts of force (gravity) and motion (velocity) to define a black hole by its unusual escape velocity – the speed of light.

#### Astronomy

##### The Universe – characteristics of galaxies

Students discover that strong evidence supports a theory that galaxies, like our Milky Way, contain super-massive black holes inside their cores.