

# KINEMATICS

Unit 4 & 5 Dr John P. Cise, Professor of Physics, Austin Community College, 1212

Rio Grande St., Austin Tx 78701 [jpcise@austincc.edu](mailto:jpcise@austincc.edu) & NYTimes June 22, 2011 by Sindya N. Bhanoo

OBSERVATORY

## In Celestial Twist, Black Hole Swallows a Dying Star

In what sounds like a one of a kind murder mystery, a dying star has fallen into a black hole and been ripped apart.

[Enlarge This Image](#)



Artist's impression of the initial stages of disruption of a star as it flies close to the central black hole of a distant galaxy. The star is tidally shredded, and begins to fall into the hole.

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Artist's impression of the end result of disruption of a star by a massive black hole. The star is disrupted into a disc around the star, which then falls into the hole, creating powerful jets. For this event we are looking down one of these jets.

The event, which was observed on March 28, was originally thought to be a gamma ray burst from a collapsing star, but researchers suspected something more sinister was at play. Their findings appear in a pair of papers published online by the journal Science. Traditional gamma ray bursts involve a deluge of high-energy photons bursting through the air. They generally result from the explosion of a star or when two objects collide. In this case the burst was unusually long, said [Joshua Bloom](#), an associate professor of astronomy at Berkeley and the first author of one of the studies. **The burst also came from the center of a galaxy four billion light years away.** Most galaxies are thought to have black holes at their center, a clue that tipped off Dr. Bloom and his colleagues. "Astronomers are not so different from real estate agents — location, location, location," he said. "This picture had emerged for me and I saw that this was a black hole swallowing up a star." The team used data gathered by the Swift Gamma Burst Mission, the [Hubble Space Telescope](#) and the Chandra X-ray Observatory to [confirm their theory](#). They also studied historical data to look for similar events involving the same black hole, but they found no other occurrences. "This is a singular event in the history of mankind," Dr. Bloom said. "This black hole was otherwise sitting dormant, a star got too close, its gas got ripped apart and in doing so some of it got spit up." There are still a number of unanswered questions that the researchers are exploring, like how large the star was in comparison to the sun, how close it got to the black hole and role of the hole's spin in the event.

**INTRODUCTION:** This black hole was recently seen eating (swallowed) a star on March 28, 2011. The light came from a galaxy 4 billion light years away.

**QUESTIONS:** (a) How many seconds are in a year? (b) How far away in meters is the black hole? (c) How far away is the black hole in km? (d) How far away is the black hole in miles? **SHOW ALL CALCULATIONS ON YOUR WAY TO EACH SOLUTION. THANKS!**

**HINT:**  $c(\text{speed of light}) = 3 \times 10^8 \text{ m/s}$ , 60 s/min, 60 min/hr, 1.61 km/mile, 365.25 days/yr, 4 billion light years =  $4 \times 10^{12}$  years

**ANSWERS:** (a)  $3.156 \times 10^7 \text{ s}$  (b)  $3.787 \times 10^{28} \text{ m}$  (c)  $3.787 \times 10^{25} \text{ km}$  (d)  $2.35 \times 10^{25}$  miles **23.5 BILLION BILLION MILES**