

HEIC0211: EMBARGOED UNTIL: 15:00 (CET) 18 NOVEMBER, 2002

## Missing link found between supernovae and black holes

Draft VNR script A-roll. Approximate duration 3:15.  
LLC/041102

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### Narration:

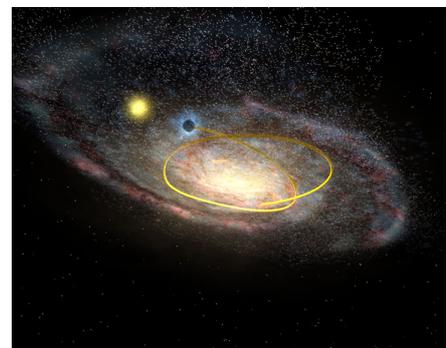
Using the Earth-orbiting Hubble Space Telescope, scientists have found the missing link between supernovae and the mysterious black holes.

A nearby black hole, hurtling like a cannonball across the plane of the Milky Way, has provided possibly the best evidence yet that black holes are made in supernova explosions.

The NASA/ESA Hubble Space Telescope is one of the most successful scientific projects of all time resulting from a collaboration between Europe and the United States. The telescope flies 600 kilometres above our image-distorting atmosphere.



*The Hubble Space Telescope, fly-by. 8s.*

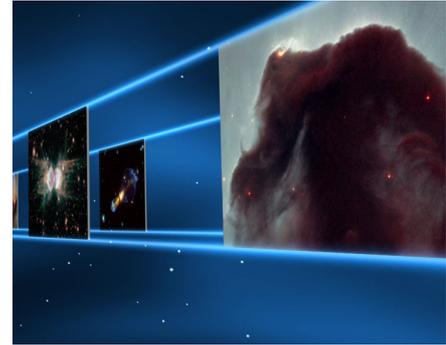


*The Milky Way 2, showing the Sun orbiting the centre and the orbit of the black hole. 10s.*



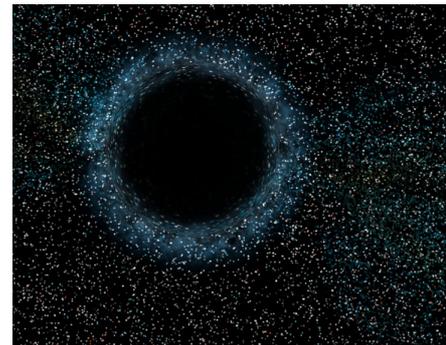
*HST2, approaching camera, slewing, opening hatch, starts to point towards Scorpius. 14s.*

From its unique vantage point it has a crystal-clear view of the Universe. The images from Hubble have amazed scientists and excited the public for the last decade. From space, Hubble has access to near-infrared and ultraviolet light, which cannot be observed from the ground.



*Image exhibition. Flying through HST's best images. 19s.*

When massive stars die, they explode violently as supernovae often leaving behind a black hole. However, the actual connection between the supernovae and the black holes has so far been missing. Black holes are notoriously difficult to find since, by their nature, they swallow all light.



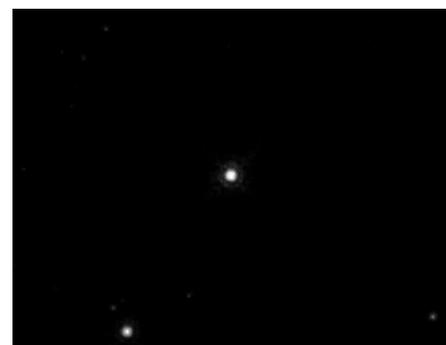
*Close ups on a supernova explosion and on a black hole passing by. 17s*

In this case, the runaway black hole, called GRO J1655-40, has a companion star, which has been tracked by Hubble. The black-hole system is located in the constellation Scorpius. Hubble's high resolution has allowed astronomers to measure the motion of the black-hole system across the sky using images taken in 1995 and 2001.



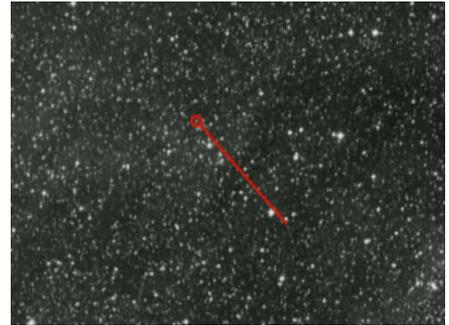
*HST continues pointing towards Scorpius, zooms, fades to Digitized Sky Survey image, fades to HST observation. 25s.*

These measurements of the motion of a black hole are the most precise performed so far with Hubble. Only Hubble's pinpoint resolution made it possible to reveal the minute motion of the black hole in the sky.



*Further zoom all the way into HST image. Blinking between 1995 and 2001 images. 10s.*

Over the next 100 000 years the black hole will continue its hurtling motion through the Milky Way.



*Zoom on Black hole on Digitized Sky Survey. Red circle. Motion is drawn as a line among the stars. 6s.*

Scientists combined the Hubble data with data from ground-based telescopes to get the velocity of the black hole through space. It is streaking across the plane of our Milky Way 4 times faster than the average velocity of the stars in the surrounding neighbourhood.



*Milky Way 1. Same as 2, but from another camera angle. 20s.*

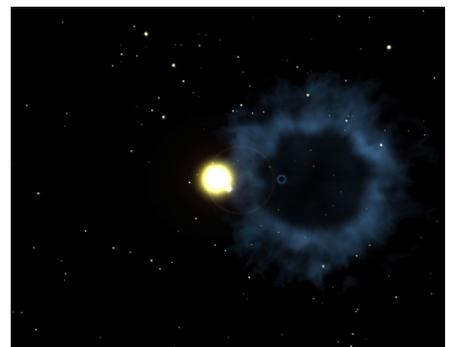
*"This is the first black hole found to be moving fast through the plane of our galaxy."*

*"This discovery is exciting because it links a black hole to a supernova."*



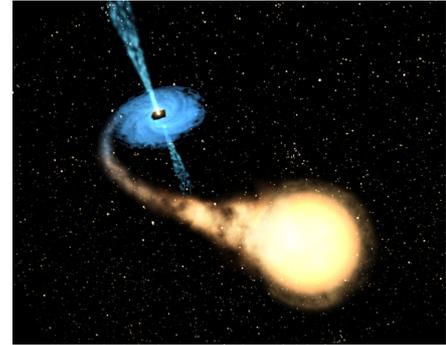
*Felix Mirabel filmed with blue screen, Milky Way 2 is shown in the background. 15s*

The most likely 'cannon' to accelerate the black hole is the explosive kick of a supernova - one of the Universe's most titanic events. The black hole and its companion star received a 'natal kick' by the explosion that sent them flying out on a long journey through the Milky Way galaxy.



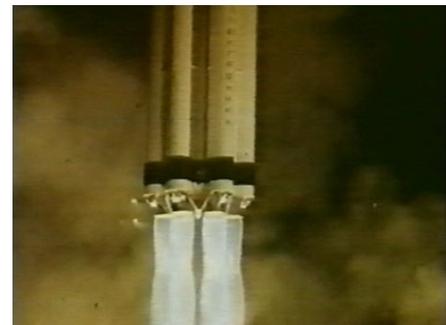
*Supernova explodes, black hole and companion star flies out and passes camera. 17s.*

As the black-hole system shoots through space, the black hole is slowly devouring its companion star, which survived the blast. Blowtorch-like jets stream away from the black hole with 90% the speed of light. Due to its similarity to the monster black holes found in centres of galaxies this black hole has been nicknamed a 'microquasar'.



*Black hole sucking gas from the companion star. Jets are seen. 18s.*

The successful launch of ESA's gamma-ray satellite Integral on 17 October 2002 opens new perspectives for this line of research and for our understanding of galactic black holes.



*Integral launch or other Integral stock footage. 11s.*

*"Thanks to Integral, we're expecting to find many more black holes. We'll track their paths in the Milky Way and gain insight into their birthplace and how they formed."*



*Integral stock footage or + Felix Mirabel voice. Or just I/V with Mirabel. 12s.*

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B-roll Shot-list.  
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<b>Misc. 3D animations of the Hubble Space Telescope</b>	1:06:09:16
<b>Zoom sequence:</b> Hubble approaches camera, points towards the constellation Scorpius. Zoom starts, fades to 4 degree Digitized Sky Survey image, fades to HST observation (Planetary Camera).	1:08:48:00
<b>Black hole motion</b> on the sky	1:09:39:13
<b>Black hole orbiting</b> in the Milky Way I	1:10:12:21
<b>Black hole orbiting</b> in the Milky Way II	1:10:30:23
<b>Supernova explosion</b> (generic)	1:10:48:24
<b>Black hole</b> (generic)	1:10:58:01
<b>Supernova explosion</b> with 'natal kick-out' of black hole and companion	1:11:09:07
<b>Black hole sucks gas</b> from companion star, creates microquasar	1:11:27:09
<b>Display of Hubble images</b> in space	1:11:45:10
<b>Hubble images</b> , stills and zooms/pans	1:12:04:11
<b>END</b>	1:22:37:07

