



c/o ST-ECF

ESO, Karl-Schwarzschild-Str.2

D-85748 Garching bei München,

Germany

Telephone: +49 (0)89 3200 6306

Cellular : +49 (0)173 38 72 621

Telefax: +49 (0)89 3200 6480

hubble@stecf.org

hubble.esa.int

PHOTO RELEASE PHOTO RELEASE

HEIC0211: EMBARGOED UNTIL: 16:00 (CET) 18 NOVEMBER, 2002

Photo release:

Missing link found between supernovae and black holes

18-November-2002 **A nearby black hole, hurtling like a cannonball through the plane of our Milky Way, has provided possibly the best evidence yet that stellar-mass black holes are made in supernova explosions. This black hole is streaking across space at a rate of 400 000 kilometres per hour - 4 times faster than the average velocity of the stars in the galactic neighbourhood. What has made it move so fast? The most likely 'cannon' is the explosive kick of a supernova, one of the Universe's most titanic events.**

When massive stars end their lives, they explode violently as supernovae. They leave either a neutron star or a black hole as a remnant, depending on how massive the star initially is. Scientists have found indirect evidence for the existence of about a dozen black holes. However, direct evidence linking supernovae and their black-hole remnants has been missing, until now.

Black holes, by definition, swallow light so they are 'invisible'. However, you can spot them indirectly. In this case, the runaway black hole has a companion star, which the ESA/NASA Hubble Space Telescope could track. Hubble's high resolution has allowed astronomers to measure the motion of this black-hole system across the sky using images taken in 1996 and 2001. Scientists combined Hubble data with those obtained from ground-based telescopes and got surprising results. The black hole is streaking across the plane of our Milky Way at a velocity of 4 times that of stars around it!

"This is the first black hole found to be moving fast through the plane of our galaxy," says Felix Mirabel of the French Atomic Energy Commission and the Institute for Astronomy and Space Physics of Argentina. Mirabel and the second author of the discovery, R. Mignani, conclude: "it must have been shot out of a supernova by the force of the explosion."

These measurements of the motion of a black hole are the most precise performed so far with Hubble. Only Hubble's acute eyesight made the observations possible. ESA's gamma-ray satellite, Integral, is also expected to generate surprising results about black holes. Integral was successfully launched on 17 October 2002. *"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,"* says Mirabel.

#

Notes for editors

For broadcasters, computer animations of the discovery plus general Hubble Space Telescope background footage is available from the ESA Television Service, see <http://television.esa.int>

This black hole, called GRO J1655-40, is observed in the constellation Scorpius. It may have been born in the inner disc of our galaxy, where the highest rate of star formation takes place. GRO J1655-40 is the second so-called 'microquasar' discovered in our Galaxy. Microquasars are black holes of about the same mass as a star. They behave as scaled-down versions of much more massive black holes that are at the cores of extremely active galaxies, called quasars. Astronomers have known about the existence of stellar-mass black holes since the early 1970s. Their masses can range from 3.5 to approximately 15 times the mass of our Sun.

Using Hubble data, astronomers were able to describe the black-hole system. The companion star had apparently survived the original supernova explosion that created the black hole. It is an ageing star that completes an orbit around the black hole every 2.6 days. It is being slowly devoured by the black hole. Blowtorch-like jets are streaming away from the black-hole system at 90% of the speed of light.

The scientists involved in these observations are:

I. F. Mirabel (the French Atomic Energy Commission & the Institute for Astronomy and Space Physics/Conicet of Argentina), R. Mignani (European Southern Observatory, Germany), I. Rodrigues (the French Atomic Energy Commission/CNPq Brazil), J.A. Combi (the Argentinean Institute for Radioastronomy), L. F. Rodriguez (UNAM, Mexico), and F. Guglielmetti (Max Planck Institute for Extraterrestrial Physics & Max Planck Institute for Plasmaphysics, Germany).

The Hubble Space Telescope is a project of international cooperation between ESA and NASA.

Image Credit: European Space Agency, NASA and Felix Mirabel (the French Atomic Energy Commission & the Institute for Astronomy and Space Physics/Conicet of Argentina)

For more information, please contact:

Lars Lindberg Christensen
Hubble European Space Agency Information Centre, Garching, Germany
Tel: +49-89-3200-6306 (089 within Germany)
Cellular (24 hr): +49-173-3872-621 (0173 within Germany)
E-mail: lars@eso.org

Felix Mirabel
The French Atomic Energy Commission & the Institute for Astronomy and Space Physics/Conicet of Argentina
Tel: +33-1-69-08-92-56 (but during 13-18 November 2002 tel. +34-922-605-200.
Cellular (24 hr): 33-69-81-47-935
E-mail: fmirabel@cea.fr

Roberto Mignani
European Southern Observatory, Germany
Tel: +49-89-32-00-64-96
E-mail: rmignani@eso.org

Ray Villard
Space Telescope Science Institute, Baltimore, United States
Tel: +1-410-338-4514
E-mail: villard@stsci.edu