Finding may help explain giant black holes

July 1, 2009
Courtesy University of Leicester and World Science staff

Astronomers are reporting that they have discovered a new class of mid-sized black hole, whose existence might help explain how the biggest black holes originated.

The finding of a black hole more than 500 times the weight of our Sun in a galaxy about 290 million light years away is reported July 1 in the research journal Nature. A light-year is the distance light travels in a year.

Until now, identified black holes have been either “super-massive” — several million to several billion times the weight of the Sun —or about three to 20 times the weight of the Sun.

The new finding is the first solid evidence of medium-sized black holes, according to astrophysicists at the Centre d’Etude Spatiale des Rayonnements in France, who detected the object with the European Space Agency’s XMM-Newton X-ray space telescope.

“While it is widely accepted that stellar mass black holes are created during the death throes of massive stars, it is still unknown how super-massive black holes are formed,” said the paper’s lead author, Sean Farrell, now at the University of Leicester, U.K.

“One theory is that super-massive black holes may be formed by the merger of a number of intermediate mass black holes. To ratify such a theory, however, you must first prove the existence of intermediate black holes.

“This is the best detection to date” of these, he added. “The identification of HLX-1 is therefore an important step towards a better understanding of the formation of the super-massive black holes that exist at the centre of the Milky Way and other galaxies.”

A black hole is an object, normally a remnant of a spent star, with such a powerful gravitational field that it permanently traps anything that passes too close, even light. This accounts for the “black” moniker, but in fact the region surrounding a black hole can be extremely bright. This is because the black hole’s high-rate gobbling up of nearby stellar material can be a rather violent process, which heats up the material so that it shines.

Astrophysicists had long believed this intermediate class of black holes, with masses, or weights, between a hundred and several hundred thousand times that of the Sun, might exist.

The new object, dubbed HLX-1 (Hyper-Luminous X-ray source 1), lies towards the edge of the galaxy ESO 243-49. It is ultra-luminous in X-rays, about 260 million times more so than the Sun, according to researchers.

The X-ray signature of HLX-1 and the lack of a counterpart in optical images confirm that it is neither a foreground star nor a background galaxy, and its position indicates that it is not

the central engine of the host galaxy, as supermassive black holes usually are, scientists said.

Using XMM-Newton observations carried out on the in 2004 and 2008, the team found that HLX-1 displayed a variation in its X-ray signature. This indicated that it must be a single object and not a group of many fainter sources. The huge radiance observed can only be explained if HLX-1 contains a black hole more than 500 times the mass of the Sun, said Farrell and colleagues.

Image: An artist's depiction of the new light source HLX-1, shown as the light blue object to the top left of the galactic bulge in the spiral galaxy ESO 243-49. (Credit: Heidi Sagerud)