

Astrophysicists detect destruction of three stars by black holes

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Researchers from Moscow Institute of Physics and Technology and the Space Research Institute of the Russian Academy of Sciences have reported registering three possible occasions of the total destruction of stars by supermassive black holes at the centers of galaxies. Details are given in an article by Ildar Khabibullin and Sergei Sazonov, accepted for publication by the *Monthly Notices of the Royal Astronomical Society* journal.

The astrophysicists used data obtained by X-ray orbiting observatories ROSAT and XMM-Newton. The former was put into orbit in 1990 and served until 1999, when XMM-Newton took over. The two satellites gathered enough information to detect very rare events, the destruction of stars by supermassive [black holes](#).

A star in a galaxy passes by a black hole closely enough to be destroyed once every 10,000 years. It is possible to detect the death of a star in a fairly distant galaxy as the destruction of a star generates a bright X-ray flare; it is only necessary to distinguish such a flare from other types of X-ray radiation. Because flares occur in a variety of astrophysical processes, the task of finding stars destroyed by black holes is quite complicated.

The researchers developed a number of methods to distinguish the destruction of a star by a black hole from other occurrences. The easiest way to filter out extraneous signals is to eliminate from consideration flares in our galaxy; there is only one supermassive black hole at the center of the Milky Way, so there clearly could not have been stars that have become victims of gravity on the periphery of our galaxy. The researchers also excluded sources of radiation that were too large (in angular measurements) and additionally analyzed the range of objects along with the dependence of brightness on time.

Since a [supermassive black hole](#) takes just a few years to fully absorb the captured matter of a destroyed star (typically, this makes up about a quarter of its original mass), observations repeated a decade later should detect significant dimming of an X-ray source. The researchers obtained sky survey data in the 1990s and in the 2000s, so they were able to detect objects whose brightness reduced by at least tenfold.

The data led to the identification of three X-ray sources labeled 1RXS J114727.1 + 494302, 1RXS J130547.2 + 641252 and 1RXS J235424.5-102053. [1RXS means that the object was first noticed during the first survey of the sky by the ROSAT telescope, and the two six-digit numbers after the letter J are angular coordinates.]

There is another object that may be a star that has been ripped apart, but the available data does not allow for distinguishing it from the active

nucleus of a distant galaxy. New data suggests that the destruction of stars near black holes occur once every 30,000 years within the same galaxy, which agrees quite well with estimates derived from observations in the visible and ultraviolet spectral range.

The uncertainty of these estimates is quite significant since they are based on a very small number of occurrences – the full sample contains no more than two dozen "credible" X-ray sources registered by various methods in different spectral bands. Progress in this area is expected to be made with the launch of the space observatory Spectrum-X-Gamma in 2016, which will be equipped with two X-ray telescopes in the soft X-ray wavelength (the Russian-German unit eROSITA) and in the hard wavelength (Russia's ART-XC). They will be used to carry out eight new legs of X-ray sky surveys within four years. The sensitivity of each shot will be several times greater than that of ROSAT.

Researchers estimate that several hundred such occurrences will be registered annually with the help of Spectrum-X-Gamma. This will not only allow them to more accurately measure the average frequency of such occurrences in the universe, but also to examine in greater detail the interaction of supermassive black holes with surrounding objects.

Provided by Moscow Institute of Physics and Technology

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