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The two colours of black holes

Scientists have found that black comes in two shades, says S.Ananthanarayanan.

Black holes are stars that have collapsed under their own weight and are so dense that the force of gravity in their vicinity sucks everything sight into itself and nothing can escape from within, not even light! As neither material things nor information can emerge, in principle, no part of what went into the hole, not even the hole itself, can ever be detected.

The glow of heavy stars

The first give-away of a black hole's presence is the emission from nearby particles that speed up as they crash into the 'black porthole to nowhere'. The tremendous temperatures and the acceleration of charged particles leads to emission of X Rays, one evidence that something like a black hole is down there.

Such radiation from speeding particles also comes from the vicinity of other very heavy objects, well short of becoming black holes. The case of the 'pulsar', which is an X-Ray searchlight, beaming flashes of X-Rays, is one such. Pulsars are 'neutron stars', which are collapsed stars where atoms have lost their charges and the star consists of just the neutron core of atoms, in the densest form of matter conceivable. In the course of reducing to a size in kilometers, from the dimensions of a star, the system begins to spin once every few seconds or faster. This is exactly like the ballerina who spins faster when she draws her arms close to herself! The whirring of charges around the star acts like a dynamo and every time the relevant axis of the star faces the earth, we receive a flash of X-Rays.

In the case of black holes, there are features of the matter being sucked in being from a companion star, with which the black hole forms a pair, like spinning dumb-bell, and also the absence of the flashing that we find with the pulsar.

Another colour of black holes

The scientist, Stephen Hawking suggested that there should be yet another emission, arising more directly from the black hole. This emission had nothing to do with speeding charges but was a manifestation of the strange things that quantum physics allows. Quantum physics allows that a 'positron-electron' pair, a pair of 'antiparticles' that annihilate each other if they should meet, can spring up from nowhere, in a fleeting violation of the law conservation of energy. It is these instances, happening near black holes, that Hawking gets hold of. In the twinkling moment that the particles exist, one of the pair gets gobbled up by the black hole and the other has to flee, the opposite way, as the celebrated "Hawking Radiation".

These are the ‘harder’ X-Rays

Calculations show that this ‘Hawking’ part should be higher energy X-rays. But nobody had picked out the two components separately so far. Scientists at the Cosmic Physics and Space Astrophysics Institute at Bologna, Italy did just that in their studies, reported last week, of X-Rays coming from 3C272, a black hole 3 billion light years away.

The data collected by the Italian-Dutch spacecraft, BeepoSAX, between 1996 and 2001 shows that there were two components in the X-Rays and these varied in intensity over different timescales.

Black-holes sing in ‘parts’

Analysis of the data over some years has helped separate the two components, the X-Rays from the ring of particles speeding ***into*** the black hole and the X-Rays from the stream flowing ***out***. The researchers hope to use the results to interpret data from other black holes and to try understanding how the two streams relate. It is exciting, that research of the invisible black hole should grow through observation and experiment!