How fast does a supermassive black hole spin? Groundbreaking measurement could help unlock the history of our galaxy

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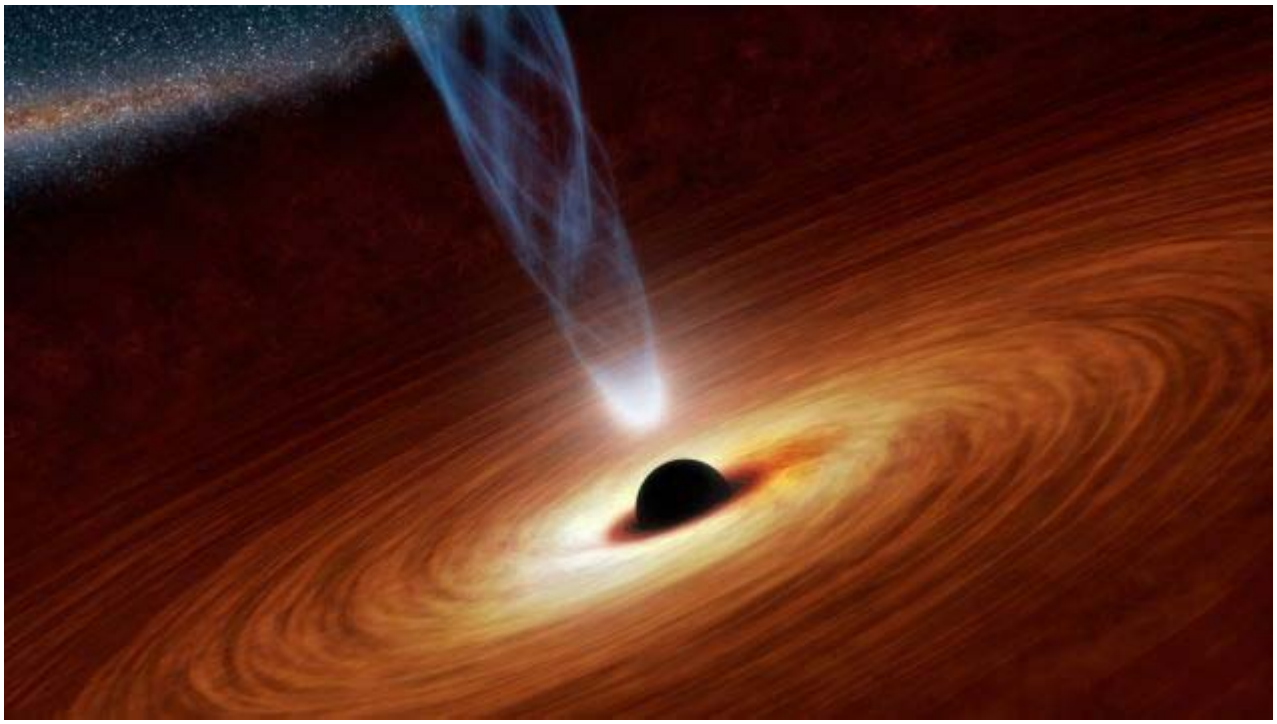
- Team say supermassive black hole at the center of the spiral galaxy NGC 1365 is spinning so fast that its surface is traveling at nearly the speed of light
- Project is first time anyone has accurately measured the spin of a supermassive black hole

Astronomers have measured the rate of spin of a supermassive black hole for the first time.
The sphere more than 2 million miles across - eight times the distance from Earth to the Moon - is spinning so fast that its surface is traveling at nearly the speed of light.

'This is the first time anyone has accurately measured the spin of a supermassive black hole," said lead author Guido Risaliti of the Harvard-Smithsonian Center for Astrophysics (CfA) and INAF - Arcetri Observatory.



An artist's impression of the spiral galaxy NGC 1365, which researchers say is spinning so fast that its surface is traveling at nearly the speed of light

The groundbreaking measurement was made using new data from the Nuclear Spectroscopic Telescope Array, or NuSTAR, and the European Space Agency's XMM-Newton X-ray satellites.
Astronomers want to know the black hole's spin for several reasons.
The first is physical - only two numbers define a black hole: mass and spin.

By learning those two numbers, you learn everything there is to know about the black hole.

Most importantly, the black hole's spin gives clues to its past and by extension the evolution of its host galaxy.

'The black hole's spin is a memory, a record, of the past history of the galaxy as a whole,' said Risaliti.

Although the black hole in NGC 1365 is currently as massive as several million Suns, it wasn't born that big.
It grew over billions of years by accrediting stars and gas, and by merging with other black holes, the researchers said.

WHY DOES A BLACK HOLE SPIN?

A black hole's gravity is so strong that, as the black hole spins, it drags the surrounding space along.

The edge of this spinning hole is called the event horizon.

Any material crossing the event horizon is pulled into the black hole.
Inspiraling matter collects into an accretion disk, where friction heats it and causes it to emit X-rays.

Risaliti and his colleagues measured X-rays from the center of NGC 1365 to determine where the inner edge of the accretion disk was located.
This Innermost Stable Circular Orbit - the disk's point of no return - depends on the black hole's spin.

Since a spinning black hole distorts space, the disk material can get closer to the black hole before being sucked in.

The new measurements published in Nature help remove the mystery of what occurs in and around black holes that are so powerful that nothing - not even light - can escape.
The immense gravitational attraction of these objects shreds and accelerates the gas and dust that has got too close.
By exploiting NuSTAR's unprecedented accuracy the researchers discovered the spin rate of this supermassive black hole at least 84 percent of the maximum theoretically allowed in physics.

Dr Guido Risaliti, of the Arcetri Astrophysics Observatory in Florence, and colleagues said: 'These results are consistent with the ones from previous observations of NGC 1365 from the X-ray astronomy satellite Suzaku.'
By studying atoms in the X-ray band as they circle around the black hole before they disappear into it they could detect the effects of the incredible gravity.

Scientists combined data from NASA's NuStar and the European Space Agency's*Photo by: ESA's*

And by teaming up with XMM-Newton they could tell how fast the black hole is spinning.
Supermassive black holes occur in the middle of all galaxies - including the Milky Way - and are created by exploding stars.
The majestic spiral galaxy NGC 1365 is some 200,000 light-years across towards the constellation Fornax and at its core lies the supermassive black hole.

Launched last year Nustar is sensitive to X-ray photons, or light particles, with energies in the range of six to 79 kiloelectron volts (keV).

This is beyond the vision of the two large-class observatories currently in orbit - Nasa's Chandra telescope and the Esa's XMM-Newton facility.

Its total mission budget is $170m (£110m) which includes two years of in-orbit operations that could be extended in 2014 if Nasa feels the telescope is delivering on its science goals.

Christopher Reynolds, professor of astronomy at Maryland University, who reviewed the findings for the journal, said: 'Supermassive black holes - with masses of millions to billions times that of our Sun - are believed to exist at the centre of essentially every galaxy.

'When these monsters feast upon the gas - and possibly the stars - within galactic centres they release enormous quantities of energy, producing a phenomenon called an active galactic nucleus (AGN).

'Far from being dark and difficult to detect, the black holes in AGNs are the most luminous spectacles in the Universe.'

This striking new image, taken with the powerful HAWK-I infrared camera on ESO's Very Large Telescope at Paranal Observatory in Chile, shows NGC 1365. This beautiful barred spiral galaxy is part of the Fornax cluster of galaxies, and lies about 60 million light-years from Earth

He said the spin of a supermassive black hole can help us unravel the mystery of its growth but is 'a difficult quantity to measure'.

Professor Reynolds said: 'These results also encourage us to push further and deeper with our X-ray observations, necessitating the development of more powerful X-ray observatories, so we can use the diagnostic power of black-hole spin to uncover the story of supermassive-black-hole growth.'