Spin of Supermassive Black Holes Measured for First Time

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Astronomers at the University of Maryland have made the first quantitative measurements of the spin of several supermassive black holes, information that is essential to understanding how these giant black holes develop and grow.

University of Maryland astronomy graduate student Laura Brenneman and Associate Professor of astronomy Christopher Reynolds have used observations by the European Space Agency's XMM-Newton X-ray telescope to examine the relativistically altered shape of the iron spectral line emitted from the accretion disks around these black holes. Comparing these data with new theoretical models for this spectral line, developed by Brenneman, they have generated measures of angular momentum, or the spin rate, of these objects. The black hole for which they have the best data is found at the center of the galaxy MCG-06-30-15. Their analysis indicates that this black hole is spinning very fast indeed, at least 98.7 percent of the maximum possible spin rate allowed by Einstein's Theory of General Relativity.

Brenneman and Reynolds, her thesis advisor at the University of Maryland, presented their findings at a press briefing at the American Astronomical Society's meeting in Honolulu Hawaiion May 29th.

"We really know very little about how supermassive black holes form and grow," said Reynolds. "We have models for how it can happen, but being able to determine spin rate is critical to our understanding of the process by which it actually happens."

One mechanism by which black holes can grow to be supermassive is through accretion of massive amounts of material, explained Reynolds, who together with Brenneman presented their findings. When black holes suck in matter they spin faster, thus a rapid rate of spin would indicate growth by accretion. Supermassive black holes can also be the product of a collision between black holes. Models indicate that such collisions tend to result in a supermassive black hole that spins at only a modest rate. Black holes can be completely defined by their mass and spin. Scientists have long been able to measure the mass of a black hole (through any number of methods), but, until now, measuring spin has been far more challenging.

Supermassive black holes have masses that are hundreds of thousands to billions of times that of the Sun. It is currently thought that most, if not all galaxies, including the Milky Way, contain supermassive black holes at their galactic centers.

Souce: University of Maryland