ACTIVE GALACTIC NUCLEI

Chaotic accretion

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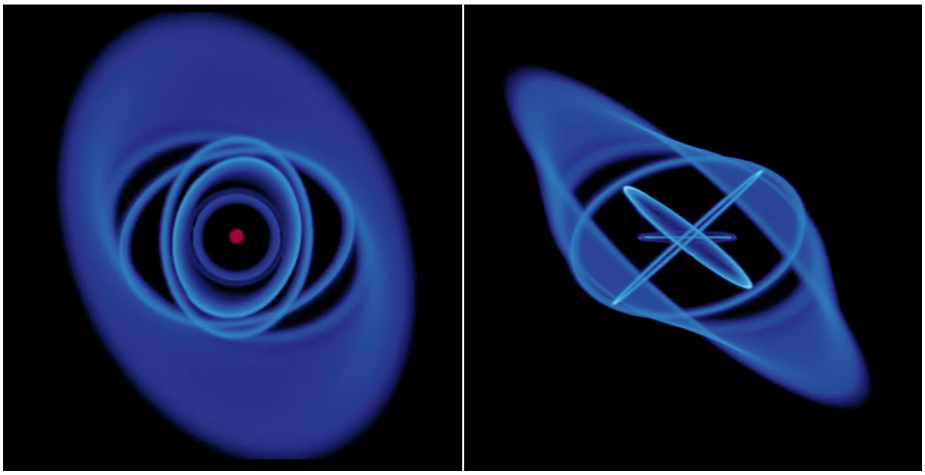

Credit: University of Leicester/K. Pounds et al.

While observing the ultrafast outflow from the luminous galaxy PG1211+143, more than one billion light years away, Ken Pounds and collaborators discovered an ultrafast inflow. Their direct observation of highly ionized material in-falling at speeds of ~0.3*c* into a 40 million solar mass black hole may reveal clues about accretion disks of active galaxies, thought to be planar and axisymmetric to the rotating black hole.

Pounds et al. used the XMM-Newton X-ray observatory over five weeks, detecting three separate outflow velocities of ~0.06*c*, ~0.13*c* and ~0.18*c*. The multiplicity of velocities suggests some kind of disk instability or variable accretion rate, at odds with a planar disk model. If there were multiple misaligned orbits, relativistic effects to the precession (Lense–Thirring effect) would lead to disk warping and tearing, with separate rings breaking off and colliding (pictured from a simulation by the same authors). The resulting 'chaotic accretion' would then cause matter to fall freely at high velocity rather than follow a slowly rotating accretion disk.

XMM-Newton tracked the clump of in-falling material for about a day before it plunged into the black hole. This transient process explains why it has not been spotted before. The additional detection of Ca, Ar, S and Si resonance lines to the usual Fe line means that detailed modelling of the absorption spectra now becomes possible. Adding multiple sight lines, such as from future missions, would enable researchers to determine the finer structure of ionized flows near a supermassive black hole in order to understand how active galactic nuclei are powered and how they evolve.

May Chiao

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