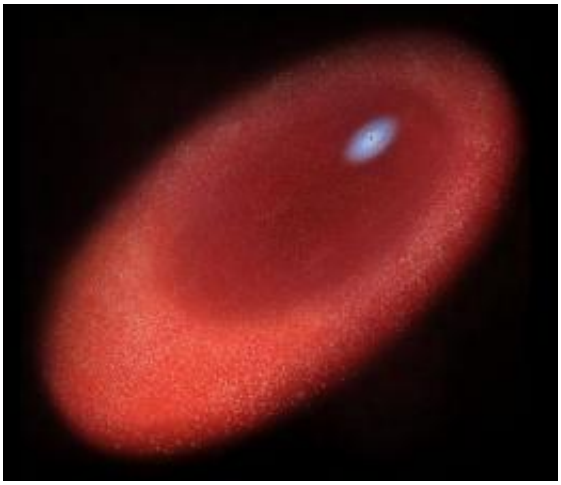
How do supermassive black holes get so big?

April 26 2010, by Lisa Zyga



This illustration of the black hole in Andromeda shows an old lopsided stellar disk (red) orbiting a black hole (black dot). An inner ring of younger stars (light blue) also orbits the black hole. The stellar disks may drag swirling gas close enough to the black hole to be consumed. Credit: A. Field, NASA, ESA.

(PhysOrg.com) -- At the center of most galaxies lie supermassive black holes that can grow to become more than a billion times larger than our Sun. However, astrophysicists don't fully understand the formation and evolution of supermassive black holes - specifically, how swirling gas from the galaxy loses its large angular momentum to allow it to be consumed by the black hole.

In a new study, astrophysicists Philip Hopkins and Eliot Quataert from the University of California, Berkeley, have proposed an explanation for how gas loses its angular momentum and successfully crosses the last 30

light years to the black hole. Their idea stems from previous observations that the supermassive black hole in the center of the Andromeda galaxy is orbited by an old lopsided stellar disk. Hopkins and Quataert suggest that when gas flows toward a black hole, it initially forms this stellar disk due to gravitational instabilities.

Eventually, the stellar disk grows in size to stretch over a distance of dozens of light years from the center of the galaxy. Once it becomes large enough, its eccentric shape pulls unevenly on the incoming gas. This torque causes different gas streams to collide, reducing the gas' momentum and allowing it to flow close enough to the black hole (less than one light year) to allow the black hole's gravity to dominate and swallow the gas. The researchers' simulations showed that this process could enable black holes to consume several solar masses of gas each year, which could have helped Andromeda's black hole to gain much of its mass.

Since Andromeda is not a unique galaxy, other supermassive black holes may also have orbiting stellar disks that transport the angular momentum of gas to the black hole's vicinity, helping to "feed" the black hole. In addition, the eccentric stellar disk's self-gravitational forces might reveal insight into active galactic nuclei and the cosmic X-ray background.

More information: Philip Hopkins and Eliot Quataert. "The Nuclear Stellar Disk in Andromeda: A Fossil from the Era of Black Hole Growth." Monthly Notices of the Royal Astronomical Society. Available at arXiv:1002.1079v2 [astro-ph.CO].
Via: New Scientist

from https://phys.org/news/2010-04-supermassive-black-holes-big.html