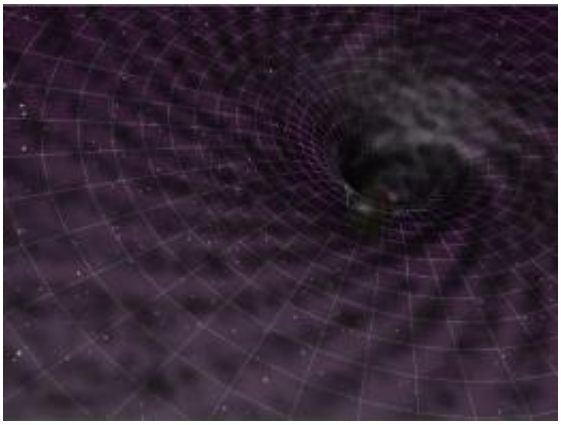
Supermassive black holes: hinting at the nature of dark matter?

March 22 2010



Artist's schematic impression of the distortion of spacetime by a supermassive black hole at the centre of a galaxy. The black hole will swallow dark matter at a rate which depends on its mass and on the amount of dark matter around it. Image: Felipe Esquivel Reed

(PhysOrg.com) -- About 23% of the Universe is made up of mysterious 'dark matter', invisible material only detected through its gravitational influence on its surroundings. Now two astronomers based at the National Autonomous University of Mexico (UNAM) have found a hint of the way it behaves near black holes. Their results appear in a letter in the journal *Monthly Notices of the Royal Astronomical Society.*

In the early Universe clumps of dark matter are thought to have attracted gas, which then coalesced into stars that eventually assembled the

galaxies we see today. In their efforts to understand galaxy formation and evolution, astronomers have spent a good deal of time attempting to simulate the build up of dark matter in these objects.

The UNAM astronomers, Dr. Xavier Hernandez and Dr. William Lee, calculated the way in which the black holes found at the centre of galaxies absorb dark matter. These black holes have anything between millions and billions of times the mass of the Sun and draw in material at a high rate.

The researchers modelled the way in which the dark matter is absorbed by black holes and found that the rate at which this happens is very sensitive to the amount of dark matter found in the black holes' vicinity. If this concentration were larger than a critical density of 7 Suns of matter spread over each cubic light year of space, the black hole mass would increase so rapidly, hence engulfing such large amounts of dark matter, that soon the entire galaxy would be altered beyond recognition.

Dr. Hernandez explains, "Over the billions of years since galaxies formed, such runaway absorption of dark matter in black holes would have altered the population of galaxies away from what we actually observe."

Their work therefore suggests that the density of dark matter in the centres of galaxies tends to a constant value. By comparing their observations to what current models of the evolution of the Universe predict, Hernandez and Lee conclude that it is probably necessary to change some of the assumptions that underpin these models - dark matter may not behave in the way scientists thought it did.

More information: A preprint of the paper can be seen at arxiv.org/abs/1002.0553

Provided by Royal Astronomical Society