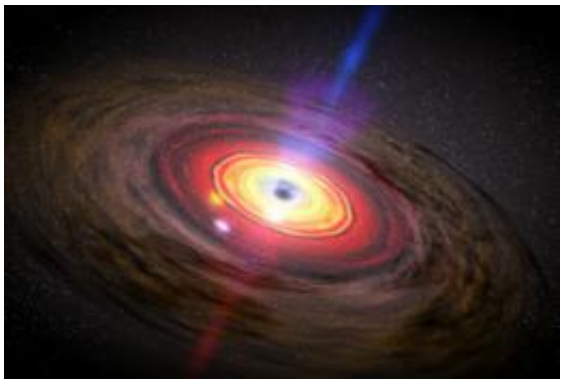
Astronomers discover new way to measure Universe

27 September 2011



Every galaxy has a supermassive black hole at its heart, millions to billions of times the mass of the Sun. When these dark hearts of galaxies actively accrete matter they become incredibly bright. These are quasars, and they outshine everything else in the universe.

(PhysOrg.com) -- Astronomers at Copenhagen's Niels Bohr Institute have found a new way to measure distances. This may not sound like much, but working out how far away something is, is one of the toughest fundamental problems in astrophysics and is central to cosmology as it allows scientists to work out the age of the Universe and what it's fundamental properties are. Because their new method uses quasars, some of the brightest objects known, scientists say they will be able to determine distances much further than achieved to date, paving the way to a better understanding of dark energy.

Finding new ways to measure cosmic distances has a strong pedigree in cosmology. In the 1990s a way was discovered to use supernovae, the explosions of massive stars, to measure distances. From that finding stemmed the discovery of the acceleration of the Universe in 1998, which showed that 70% of the Universe was made up of dark energy.

Now, Dr. Darach Watson and colleagues have discovered a way to find accurate distances using quasars. Quasars are powered by the supermassive black holes at the hearts of galaxies, and are so luminous that they can vastly outshine all the stars in their host galaxy combined. Due to their extreme luminosity, scientists have been searching for ways to use them to measure distances since they were discovered in the 1960s. After more than four decades, those attempts have finally been successful.

"It was a discovery waiting to happen," says Dr. Kelly Denney, a member of the team. It has been known for some time that the size of the gas cloud falling into the supermassive black hole is related to the luminosity of the quasar. Watson and colleagues realised that new data on the sizes of gas clouds that were being measured for other reasons were now accurate enough to allow them to predict the luminosities of the quasars. Knowing how bright the quasars appeared from earth, they could easily determine how far away they were.

Quasars can be detected to very large distances, much farther than supernovae, which are currently the best measure of distance. "That's what makes quasars so exciting," says Watson, "seeing farther away means seeing farther back in time, and knowing how the universe expanded with time is the key to understanding dark energy." Being able to measure the universe accurately at great distances will have profound implications for scientists' future understanding of dark energy and the ultimate fate of the cosmos.

Provided by Niels Bohr Institute