Hidden Population of Powerful Black Holes Revealed in Large Sky Survey

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A team of Sloan Digital Sky Survey (SDSS-II) scientists, led by Princeton University's Reinabelle Reyes and including astronomers at Penn State, has identified a large number of "hidden quasars" -- supermassive black holes in the centers of galaxies that are shrouded in light-absorbing dust and gas.

According to Donald Schneider, coauthor of the paper and Professor of Astronomy at Penn State, "If one examines a photograph of one of the hidden quasars we discovered, it appears to be just an ordinary galaxy, although quasars are typically are 10 to 100 times more luminous than the Milky Way Galaxy." Schneider is the chair of the SDSS-II science group that studies quasars, which are powered by glowing, super-heated gas as it swirls into black holes a billion times more massive than the Sun.

The research team, which will present its discovery on 9 January 2008 at the annual meeting of the American Astronomical Society in Austin, Texas, has submitted a paper describing the research for publication in the *Astronomical Journal*. Using the distinctive light-spectrum signature that even highly obscured quasars show as a marker, the SDSS-II team sifted through more than a million spectra to discover 887 hidden quasars, by far the largest sample of these objects ever found.

"A large survey like SDSS-II is important because quasars are about 10,000 times rarer than are normal galaxies," explains Reyes. "We determined how common hidden quasars are, especially the most

luminous ones. Perhaps more interestingly, we determined how common they are relative to normal quasars," said team member Nadia Zakamska, a NASA Spitzer Fellow at the Institute for Advanced Study in Princeton. "We found that hidden quasars make up at least half of the quasars in the relatively recent Universe, implying that most of the powerful black holes in our neighborhood had previously been unrecognized."

Michael Strauss of Princeton University explains that powerful black holes are more common in the last eight billion years of cosmic history than had previously been thought. "Moreover, because the light from these hidden quasars previously had been unaccounted for, black holes turn out to be more efficient in converting the energy of in-falling matter into light than we had thought."

This result also has implications for theoretical models of quasars. "The relative numbers of hidden versus normal quasars tell us something about how dust and gas typically are distributed around these objects," explains Julian Krolik, a collaborator from Johns Hopkins University. "If the dust covers a large fraction of the area around a black hole, this object would more likely appear as a hidden quasar. So the large number of hidden quasars discovered by the SDSS team implies that most of the light emitted by quasars is actually obscured."

Source: Penn State University