Evidence found for mid-sized black hole near center of Milky Way

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(Phys.org)—A team of researchers with Keio University in Japan has found evidence of a mid-sized black hole near the center of the Milky Way galaxy. In their paper published in the journal *Nature Astronomy*,

the group describes their study of a gas cloud cluster near the center of our galaxy and why they believe it offers evidence of a mid-sized black hole.

Over the years, scientists have found a lot of physical evidence of large and small black holes, but very little evidence for those in the mid-size range. This has led to an intense search, which until now, has come up mostly empty—mid-size black holes are exceedingly difficult to spot.

The team reports that last year, they discovered a gas cloud near the center of the Milky Way that appeared to behave in odd ways—some of the gasses were moving faster than others. The cloud, named CO-0.40-0.22, was intriguing because not only did it represent the possibility of finding an intermediate black hole, but it could also explain how massive black holes come to exist at the centers of galaxies, such as our own Milky way.

The team originally spotted the gas cloud using the Nobeyama radio telescope in Japan—but to learn more about what they had found required something bigger, so they ventured to Chile, where they gained access to the Atacama Large Millimeter/submillimeter Array. The researchers found that there was a dense part of the gas cloud near its center that also showed varying velocities. Better yet, just next to the clump, they found a source of radio waves that was very similar to those generated from the giant black hole at the center of Milky Way, but 500 times weaker. The two findings together suggested very strongly the presence of a mid-sized black hole. To add further evidence, the researchers built a simulation of the gas cloud and its characteristics, particularly the gas velocities, and found that it, too, pointed to a mid-sized black hole.

These findings offer strong evidence of a mid-sized black hole, though it is not clear how it might have come to that location. But as more

research is done and the find is confirmed, the mid-sized black hole could explain how giant black holes at the centers of galaxies are formed—by swallowing nearby mid-sized black holes, perhaps.

More information: Tomoharu Oka et al. Millimetre-wave emission from an intermediate-mass black hole candidate in the Milky Way, *Nature Astronomy* (2017). DOI: 10.1038/s41550-017-0224-z

Abstract

It is widely accepted that black holes with masses greater than a million solar masses (M⊙) lurk at the centres of massive galaxies. The origins of such 'supermassive' black holes (SMBHs) remain unknown, although those of stellar-mass black holes are well understood. One possible scenario is that intermediate-mass black holes (IMBHs), which are formed by the runaway coalescence of stars in young compact star clusters, merge at the centre of a galaxy to form a SMBH3. Although many candidates for IMBHs have been proposed, none is accepted as definitive. Recently, we discovered a peculiar molecular cloud, CO–0.40–0.22, with an extremely broad velocity width, near the centre of our Milky Way galaxy. Based on the careful analysis of gas kinematics, we concluded that a compact object with a mass of about 10^5M⊙ is lurking in this cloud. Here we report the detection of a point-like continuum source as well as a compact gas clump near the centre of CO–0.40–0.22. This point-like continuum source (CO–0.40–0.22*) has a wide-band spectrum consistent with 1/500 of the Galactic SMBH (Sgr A*) in luminosity. Numerical simulations around a point-like massive object reproduce the kinematics of dense molecular gas well, which suggests that CO–0.40–0.22* is one of the most promising candidates for an intermediate-mass black hole.