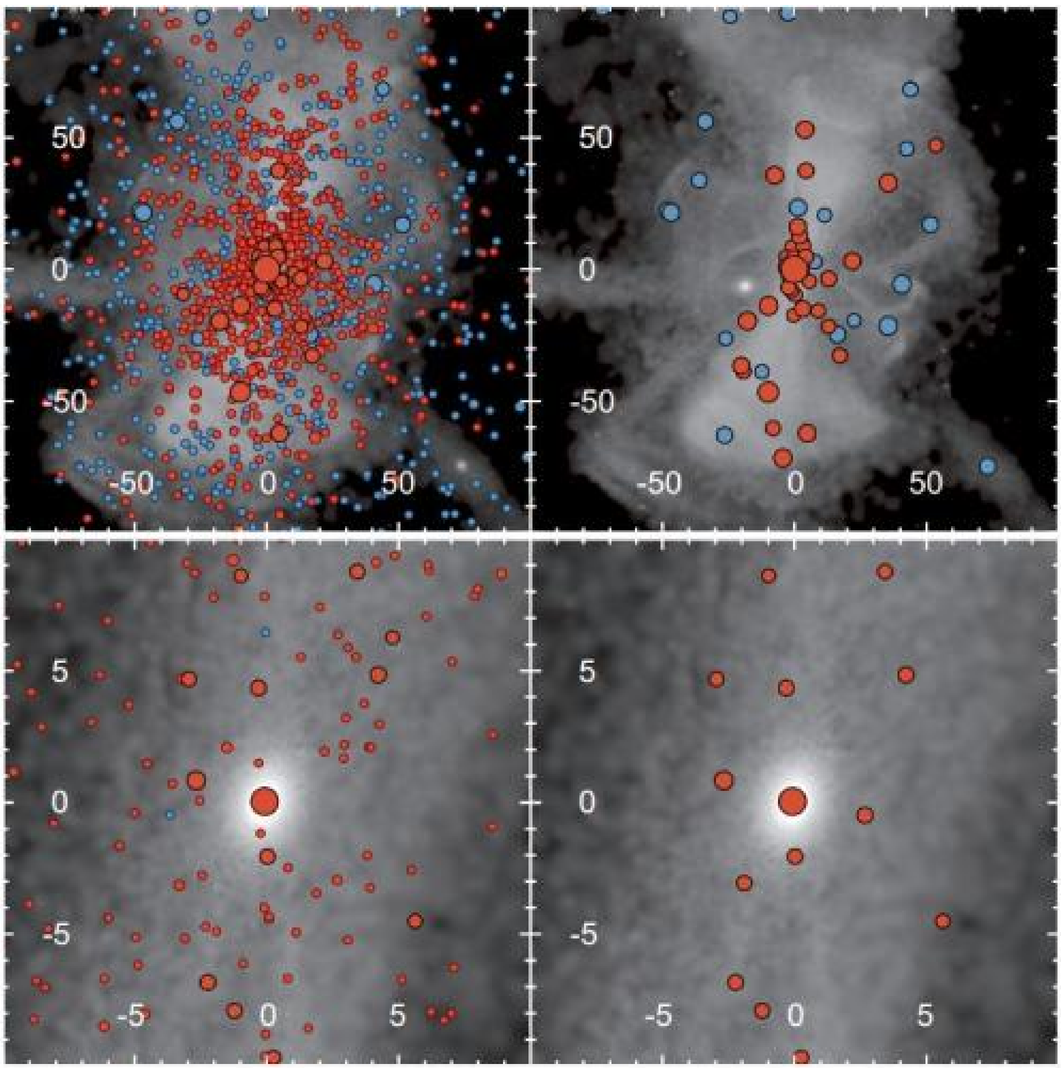
Simulations indicate Milky Way may have up to 2000 black holes in its halo

April 2 2013, by Bob Yirka



Projected distribution of IMBHs in the Galactic halo today. Credit: arXiv:1303.3929 [astro-ph.CO]

(Phys.org) —Valery Rashkov and Piero Madau, space scientists with the University of California have uploaded a paper to the preprint server *arXiv* in which they suggest that the Milky Way galaxy likely has between 70 and 2000 intermediate-mass black holes (IMBHs) existing in its outer edges. They came to this conclusion by building a computer model that mimics what they believe occurred when galaxies, and by extension, black holes merged during their formative years.

In building their simulation, the researchers began with the idea that when galaxies form, they have a "seed" black hole at their center. Over time, they suggest, some early galaxies ran into one another, merging as they did so, causing the black holes at their respective centers to merge as well. But not all couplings worked out, their simulations show. Because of gravitational waves created by such collisions, smaller black holes could be ejected, and would as a result, travel all the way to the outer reaches of the galaxy where they would reside alone in space.

But that's not the end of the story, the simulations also showed that such ejections occurred less than 20 percent of the time and that the IMBHs ejected fell into two classes: Naked and Clothed. The naked IMBHs were those that had their sub-halos destroyed in the merger, while the clothed ones were those that had dark matter satellites that survived. Naked IMBHs, they say, would number slightly fewer than those that were clothed. Conversely, when galaxies merge and neither of their merging black holes is ejected, the two combine to form a single massive black hole that remains in a stable state. This can happen many times of course, leading to galaxies with black holes that have nearly unfathomable mass.

Proving the simulations correct will likely be a daunting task, as observers can't see the IMBHs directly—any light inside of them cannot escape the immense gravity they exert. The hope is that observers will be able to detect those that are clothed, by noting the material that remains around them, or by observing the motion of other bodies that are close enough to be impacted by their gravity.

More information: A Population of Relic Intermediate-Mass Black Holes in the Halo of the Milky Way, arXiv:1303.3929 [astro-ph.CO] arxiv.org/abs/1303.3929

Abstract
If "seed" central black holes were common in the subgalactic building blocks that merged to form present-day massive galaxies, then relic intermediate-mass black holes (IMBHs) should be present in the Galactic bulge and halo. We use a particle tagging technique to dynamically populate the N-body Via Lactea II high-resolution simulation with black holes, and assess the size, properties, and detectability of the leftover population. The method assigns a black hole to the most tightly bound central particle of each subhalo at infall according to an extrapolation of the M_BH-sigma_* relation, and self-consistently follows the accretion and disruption of Milky Way progenitor dwarfs and their holes in a cosmological "live" host from high redshift to today. We show that, depending on the minimum stellar velocity dispersion, sigma_m, below which central black holes are assumed to be increasingly rare, as many as ~2000 (sigma_m=3 km/s) or as few as ~70 (sigma_m=12 km/s) IMBHs may be left wandering in the halo of the Milky Way today. The fraction of IMBHs kicked out of their host by gravitational recoil is

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