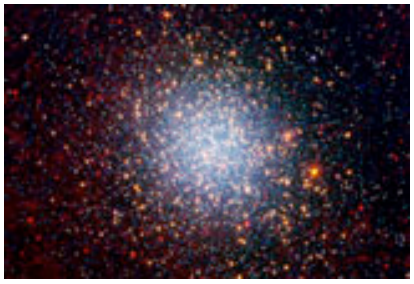

Middleweight Black Holes Nearly Ruled Out

By Space.com Staff

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There is no middle ground when it comes to black holes, which tend instead to be either petite or gargantuan, a new study suggests.

Black holes are known to exist in two classes: The stellar variety result from exploded massive stars and typically pack the mass of a few stars. The super-massive class can weigh millions or billions of stellar masses and reside at the centers of galaxies. Astronomers have debated for years whether a middleweight category exists, with evidence several times suggesting they do but then being refuted.

Now, astronomers have scoured one of the few suspected hiding spots for medium-sized black holes in a globular cluster, and conclude they are rare or nonexistent.

"Some theories say that small black holes in globular clusters should sink down to the center and form a medium-sized one, but our discovery suggests this isn't true," said Daniel Stern, an astrophysicist at NASA's Jet Propulsion Laboratory in Pasadena, Calif., and co-author of the study detailed in the Aug. 20 issue of *Astrophysical Journal*.

Scientists had thought that medium black holes might lie hidden among millions of stars in globular clusters, which sit within galaxies containing hundreds of billions of stars. Such black holes ranging in size from 1,000 to 10,000 times the mass of the sun should sit inside globular clusters like scaled-down versions of galactic black holes — at least in theory.

Previous studies have hinted at the existence of medium black holes, fingering star clusters with suspiciously large masses.

To see if there was anything to this, Stern worked with researchers led by Stephen Zepf, an astronomer at Michigan State University in East Lansing, to probe a globular cluster located 50 million light-years away in a neighboring galaxy. (A light-year is the distance light will travel in a year, or about 6 trillion miles or 10

trillion kilometers.)

They eventually found the X-ray signature of an active black hole in the globular cluster named RZ2109, using the European Space Agency's XMM-Newton telescope.

Next, the researchers determined the size of the black hole by using the W.M. Keck Observatory on Mauna Kea in Hawaii to get the chemical fingerprint of the globular cluster. Computer simulations of the chemical analysis revealed high-speed "winds" coming out of the black hole, indicating that it was baby consuming too much material and spitting some of it out.

"If an intermediate-sized black hole were accreting this material, it wouldn't be too big of a deal for it," Zepf said. "But if a small black hole were accreting this material, it would be a lot for it to take and therefore some material would be ejected in the form of high winds."

The astronomers estimated that the black hole was relatively tiny at just 10 times the mass of our sun.

"If a medium black hole existed in a cluster, it would either swallow little black holes or kick them out of the cluster," Stern explained.

Zepf suggested that medium-sized black holes might still lie hidden in dwarf galaxies on the outskirts of larger galaxies such as our Milky Way, but it would be difficult to track down.