Beware the Piranha

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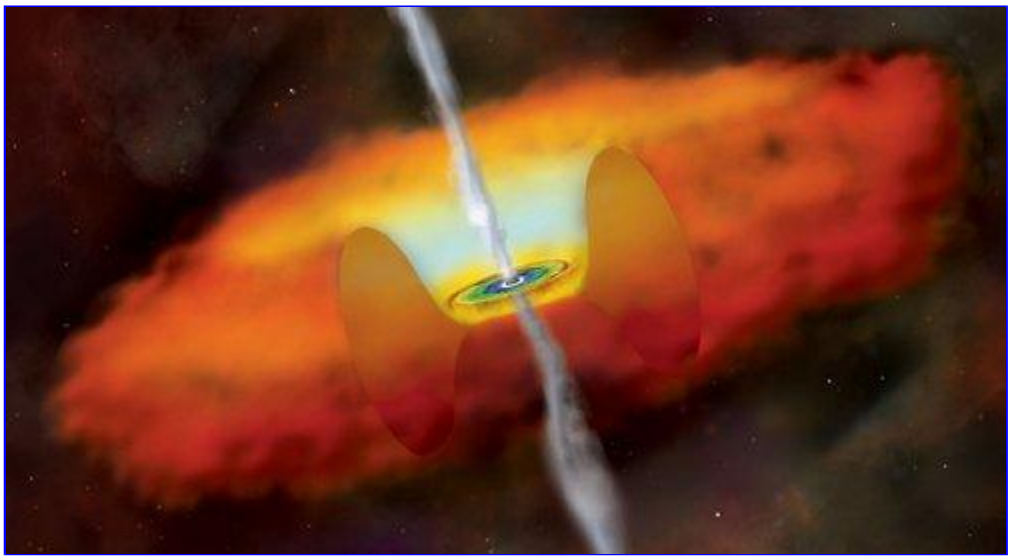
July 27, 2007: Deep in the heart of the Milky Way galaxy lurks an extraordinary black hole. Astronomers call it "supermassive." It has been feeding on the core of our galaxy so long, the hole has accumulated more than a million Suns of mass inside its pinprick belly.

How do we know it's there? You can't *see* a black hole. It reveals itself whenever an errant star or cloud of gas meanders too close. Matter falling into the hole is ripped apart and superheated, emitting bursts of high-energy radiation just before it disappears over the event horizon. Occasionally a burp of X-rays emanates from the Milky Way's core, and astronomers check off another meal.



Above: Matter swirls into a growing supermassive black hole--an artist's concept. [More]

Today these burps are seldom, but among astronomers it is widely thought that the Milky Way's "monster in the middle" used to be more active--frighteningly so. Paul Martini of Ohio State University (OSU) explains: "Billions of years ago, when our galaxy was young, there was more 'food' in the core—lots more gas and stars for the black hole to consume." He believes there could have been "a real feeding frenzy" lighting up the center of the Milky Way like a beacon visible half-way across the Universe.

Could this be true?

Finding out requires traveling back in time--a trick, believe it or not, astronomers are able to perform. "By looking at galaxies billions of light years away, we can see them as they were billions of years ago," explains Martini. "This can give us a clue to the state of the Milky Way when it was young."

So, in an effort led by OSU astronomy graduate student Jason Eastman, Martini and colleagues used data from NASA's Chandra X-ray Observatory to examine 12 clusters of galaxies ranging in distance from 2.4 to 5.7 billion light years away. Their purpose: to learn how galactic

cores change over time.

What they saw reminded Eastman of "piranhas in a very well-fed aquarium." Younger galaxies tended to be very active; supermassive black holes at their cores were furiously consuming matter and producing copious X-rays in the process.

Older galaxies, on the other hand, were relatively calm; the frenzy was subsiding. "It's not that the black holes were no longer hungry," says Eastman, "they were just running out of things to eat." The ratio of active X-ray cores in the galaxies they analyzed, younger vs. older, was about 20 to 1.

Right: A Chandra X-ray image of one of the clusters of galaxies used in Eastman et al's study. [More]

"The food, or fuel for a central black hole, is primarily thought to be interstellar gas," adds Martini. "It is likely that an occasional star is also swallowed, but most researchers agree that clouds of gas are the main fuel source."

Hence the big picture: When galaxies are young, a black hole forms at the core. Why? "Because that is the bottom of the galaxy's gravitational potential well," answers Martini. "Gas, stars, even smaller black holes will settle to the center of the galaxy over time." At first, gas is abundant, and the black hole feeds greedily, announcing itself to the cosmos via high-energy X-rays. As time passes, the core is depleted of gas and feeding subsides. By the time a galaxy is as old as the Milky Way (10+ billion years), the central black hole has grown to millions of solar masses, but only takes an occasional meal. The fish is hungry, but the water is nearly empty.

A note to the stars: Beware the Piranha.