

## Monster black holes, quietly cruising the cosmos?

by Bend\_Weekly\_News\_Sources

Two merging black holes can generate a recoil so powerful, the merged hole shoots out of its host galaxy at up to 2,500 miles per second, according to a new computer simulation. Its creators said the work shows for the first time that these violent events, which follow mergers of galaxies containing black holes, can totally eject the black holes. So these tiny objects may be cruising through the universe, virtually invisible unless they should crash into something. But don't worry, astronomers said. Most of the universe by far is empty space. The odds that a black hole will streak through our solar system are tiny. Black holes are extremely compact objects that contain so much matter crammed into so small a space that their gravity becomes overpowering and sucks in everything near by, including light. Despite their light-eating talents, many black holes are associated with intense light emissions, because the infalling objects heat up and shine. But a black hole with nothing to feed on, called a "quiescent" black hole, is dark. Most luminous galaxies are believed to contain a giant, or super massive, black hole at their center. The simulation, led by Manuela Campanelli at the Rochester Institute of Technology, N.Y., studied the best conditions for mergers to produce recoil speeds high enough to free a super massive black hole from its host galaxy. The recoil would result when, upon crashing, the black holes create an exotic type of radiation called gravitational waves. In Campanelli's scenario, two black holes approach and start to orbit each other. To produce total ejection, they should have equal masses and spin as fast as possible. They must be tilted with their axes of rotation lying in the plane of their orbit, and must spin in opposite directions. They spiral toward one another, and when they merge, the resulting object is kicked off perpendicularly to the plane of orbit. Some astrophysicists have argued that such conditions are rather unlikely; scientists said the probability of such a confluence of events remains a question for future research. Past calculations have found that black hole ejections may not be uncommon. But the expelled black hole can easily fall back into the galaxy due to continuing gravitational attraction between the two, just as a cannonball shot to the sky returns to the ground. A second new study, by Abraham Loeb of Harvard University in Cambridge, Mass., examined the possibility of detecting a black hole if it is expelled. If it's surrounded by gas, he said, that gas will emit powerful light. Unfortunately, by the time it leaves the galaxy, it will likely exhaust its gas supply and go dark. Nonetheless, one invisible object known as HE0450-2958, estimated to lie more than three billion light-years away, is theorized by some to be an ejected super massive black hole. One of the researchers who advanced the proposal has said this black hole may be one of those that one day returns to its home galaxy. It's estimated to have been moving much more slowly on average than the fully-ejected monoliths that Campanelli studied, enhancing the likelihood of an eventual fall-back. Loeb's and Campanelli's studies are to appear in forthcoming issues of the research journal Physical Review Letters.

Courtesy American Physical Society and World Science staff

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