MILKY WAY

Charge in the hole

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Black holes have mass, angular momentum and potentially a charge. While we have been measuring the first two routinely for some time now, constraining a black hole's charge is much more difficult. Michal Zajaček and collaborators place stringent theoretical and observational limits on the charge of the black hole lurking at the centre of the Milky Way, nicknamed Sgr A*, and propose an observational way to test those limits.

We know that Sgr A* is embedded in hot extended plasma and a large-scale, ordered magnetic field, both of which present ways to charge it. Using up-to-date observational constraints on these two components, the authors model the way that charge can be transferred to Sgr A*, placing a theoretical upper limit of $\leq 3.1 \times 10^8$ C on the charge of Sgr A*. Among the considerations that their calculations take into account are the rotation of the black hole, the surrounding circumnuclear medium, and the ordered magnetic field in the Galactic Centre region.

The authors then show that, given the calculated limit, observations of the black hole's shadow by facilities such as the Event Horizon Telescope will not be able to differentiate between a neutral and a charged black hole. Instead, high angular resolution (~0.1 arcsec) observations in the X-ray part of the spectrum would be able to identify a plateauing or decrease in the bremsstrahlung emission profile from Sgr A* that would be indicative of a positive charge. Using the best available X-ray data from the Chandra X-ray telescope (at a resolution of 0.4 arcsec), the authors place an observational upper limit of $\leq 3 \times 10^8$ C on the Sgr A* charge.

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