BLACK HOLES

Nearing the horizon

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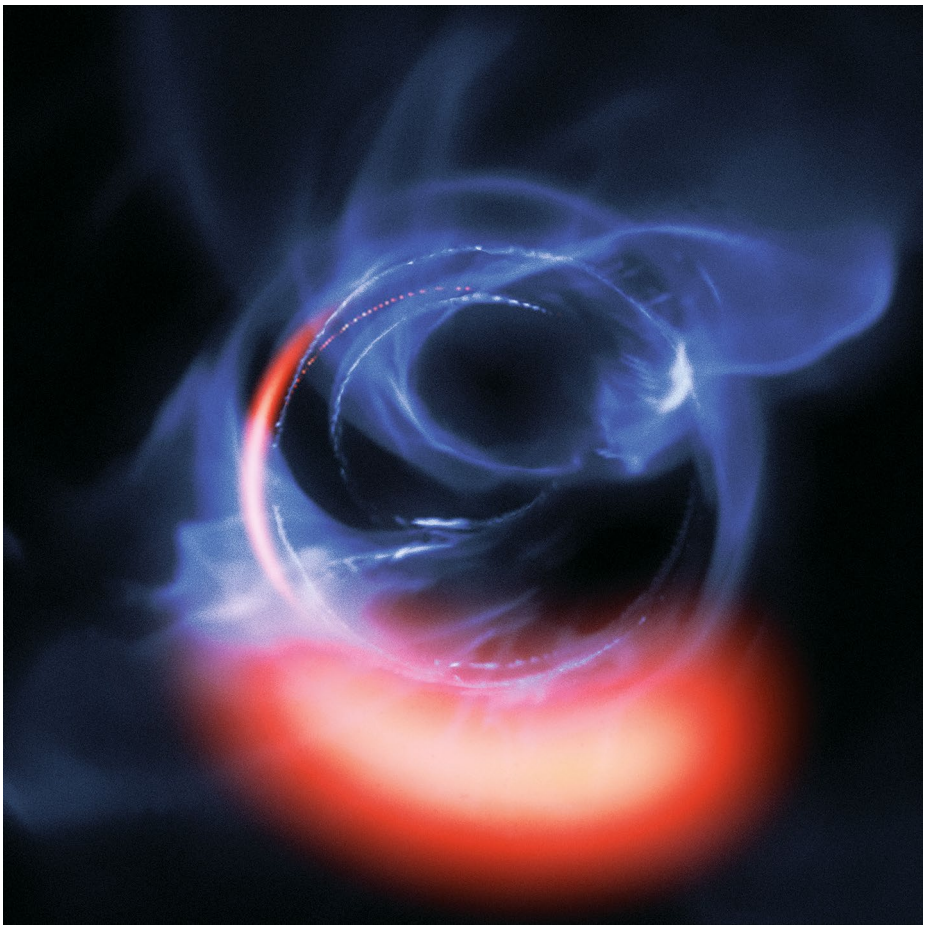

Credit: ESO/Gravity Consortium/L. Calçada

The GRAVITY collaboration's investigation of the very innermost regions of the Milky Way has revealed more information on central source Sgr A* and delivered further evidence that Sgr A* harbours a supermassive black hole (SMBH). While obtaining observations that provided a precise description of the orbital motion of star S2 around Sgr A*, the GRAVITY instrument recorded three near-infrared flares from what is most likely to be the accretion disk of the SMBH (see artist's impression). The flares are thought to originate either from magnetic reconnection (analogous to solar flares) or from magnetic shocks between energetic electrons and the very hot gas orbiting close to the innermost stable orbit around Sgr A*.

The flares (also called bright states) lasted from 30–90 minutes, and at peak were more than 2 mag brighter than the median brightness of Sgr A* in the K_S band (equivalent in brightness to star S2). It is not clear whether the duration of the flares was determined by the cooling time or the dispersal time due to differential rotation. The hotspots moved at ~0.3*c*, tracing out more than half of a closed, clockwise loop (consider a circular orbit seen nearly face-on). All three flares could be fit with the same orbital model (for a Schwarzschild–Kerr black hole of 4 million solar masses), using an orbital radius of 6–10 gravitational radii and a period of 33–65 min. Interestingly, a solution for a highly spun-up Kerr black hole could also be found; this solution would imply a retrograde orbit.

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