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3D geometry and magnetic connections of erupting black hole jet

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In recent years, the Magnetically Arrested Disc (MAD) model of accretion flows onto spinning black holes has gained significant attention due to its consistency with several observations, including those of Sgr A* and M87* . Such discs support powerful relativistic jets and episodic magnetic flux eruptions powering high-energy flares, which were also found to impact the structure of the inner accretion flow. In this work, we investigate the influence of the eruptions on the structure of the relativistic jets and the accretion flow with the help of extreme-resolution (effectively 5376×2304×2304 cells) general relativistic magneto-hydro-dynamical simulations first presented in Ripperda et al (2022). We investigate the 3D structure of jets, including the axisymmetric component as well as departures from axisymmetry, to distances of ~ 10^3 gravitational radii at different stages in the cycle of magnetic flux accumulation and eruptions. The impact of external magnetic flux tubes on the jet structure is particularly strong after a major eruption weakens the jets. We trace extensive samples of magnetic field lines to examine the magnetic connectivity between the jets, the wind, the accretion flow and the hotspots ejected from the jet during eruptions. We describe how the ejected magnetic flux tubes connect equatorial hotspots with the jet spine/sheath while crossing the wind region at various post-eruption stages.

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