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Black Hole Jets from MRI-Generated Magnetic Fields

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We propose a scenario for launching relativistic jets from rotating black holes, in which small-scale magnetic flux loops, sustained by disc turbulence, are forced to inflate and open by differential rotation between the black hole and the accretion flow. This mechanism does not require a large-scale net magnetic flux in the accreting plasma, whose presence in the environment of the central engine is questionable in many jet sources. Estimates suggest that the process could operate effectively for a wide range of systems, and particularly naturally and efficiently when the accretion flow is retrograde. We present the results of general-relativistic force-free electrodynamic simulations demonstrating the time evolution of the black hole's magnetosphere, the cyclic formation of jets, and the effect of magnetic reconnection. The jets are highly variable on timescales $\sim$ 10-10^3 $r_{\rm g}/c$, where $r_{\rm g}$ is the black hole's gravitational radius. The reconnecting current sheets observed in the simulations may be responsible for the hard X-ray emission from accreting black holes.

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