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3D GRMHD Simulations of Tilted Disks: Magnetically Driven Retrograde Precession

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Accretion disks around black holes are typically thought to be misaligned with the black hole’s spin axis due to the random angular momentum of infalling gas. Using 3D general relativistic magnetohydrodynamic (GRMHD) simulations, we investigate the accretion process of tilted disks. Contrary to the conventional understanding that prograde precession is driven by the Lense-Thirring effect, we report, for the first time, magnetically-driven retrograde precession in self-consistent simulations. Our results show that the black hole’s rotation aligns the magnetic field configuration with the spin axis, generating a significant vertical magnetic field. We estimate that the vertical magnetic field exerts a stronger torque than the Lense-Thirring torque, leading to retrograde precession. This work provides new insights into the dynamics of magnetized accretion disks around rotating black holes.

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