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Resistive GRMHD simulations of accretion disks around Kerr black holes: connecting large and small scales

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Accretion on compact objects is commonly considered the most plausible mechanism to power up a list of astrophysical systems (such as AGNs, GRBs, X-Ray Binaries, etc. . .) and in particular magnetic fields are believed to play a major role in enabling the accretion process through the development of magnetic instabilities. We investigated the effects of a finite resistivity in a magnetized plasma orbiting around a rotating black hole in a fully covariant framework, providing a self-consistent closure for the Ohm law and performing 3D GRMHD simulations with a highly parallelized version of the ECHO code.
We studied in particular the development of the Papaloizou-Pringle instability (PPI) and how it is affected by non-ideal effects, starting with different magnetic configurations and disk models.
We also investigate the effects of a mean-field dynamo closure on axisymmetric disks, in order to address the question about the origin of the large-scale magnetic fields required in such systems: starting from a kinematic regime, we extend previous results to take into account a fully dynamical development of the magnetic field through a quenched $\alpha\Omega$-dynamo.

Primary author: BUGLI, Matteo (Max Planck Institute for Astrophysics)

Co-authors: Dr MUELLER, Ewald (Max Planck Institute for Astrophysics); Dr DEL ZANNA, Luca (Universita' degli Studi di Firenze); Dr BUCCIANTINI, Niccolo' (INAF); Dr MONTERO, Pedro (Max Planck Institute for Astrophysics)

Presenter: BUGLI, Matteo (Max Planck Institute for Astrophysics)

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