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# Dynamo action in a Radiatively Inefficient Accretion Flow

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Jets are observed in the low/hard state of a transient black hole binary (BHB). Jet production is thought to be connected to the presence of a radiatively inefficient accretion flow (RIAF) and a large-scale magnetic field close to the accreting black hole (BH).[1] However, the source of the large scale field is not quite obvious. It is possible to have an in-situ generation of the magnetic field in the accretion flow by a dynamo action. We investigate the magnetorotational instability (MRI)[2] driven dynamo in a geometrically thick (H/R ~1) RIAF by performing 3D global MHD simulations.[3] We use the mean-field paradigm to describe the dynamo action in the RIAF.[4] We observe an intermittent dynamo cycle (see Fig. 1) unlike the regular cycles seen in the simulations of a geometrically thin (H/R<<1) standard disc.

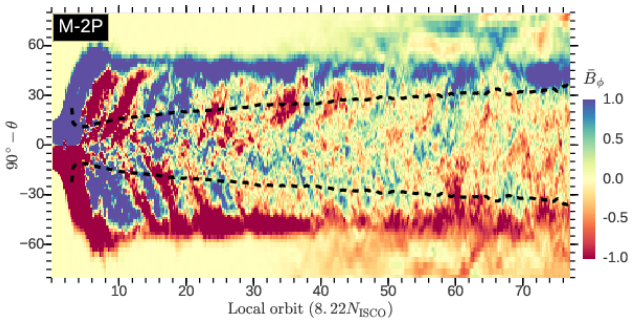


Fig. 1. Butterfly diagram: spatio (latitude)-temporal variation of mean toroidal magnetic field at a radius r=20. Time is expressed in units of local orbit at that radius.

Intermittency in the dynamo cycle is related to the slightly sub-Keplerian nature of the angular velocity.[3]

For the first time, we also obtain the spatial distribution of the turbulent dynamo coefficients in the poloidal plane (r, \theta) for the MRI dynamo in the accretion flow.[4] We find the evidence of a weak \alpha-effect that is inefficient to produce ordered poloidal magnetic fields. Additionally, we observe the presence of a strong turbulent pumping transporting mean magnetic fields radially outward as shown in Fig. 2. We conclude that dynamo action is inefficient in generating ordered large-scale magnetic field in the RIAF. Assuming a truncated disc to exist in the low/hard state of BHBs, we propose a plausible scenario where the ordered large-scale magnetic fields can be accumulated close the BH giving rise to a favourable condition for the production of the jets.

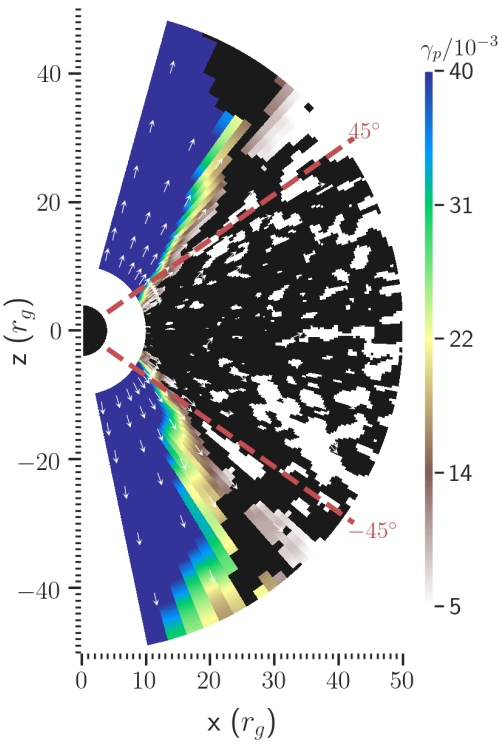


Fig. 2. Poloidal distribution of turbulent pumping term (combination of radial and meridional components). Colour shows the magnitude and arrows the direction. A black mask is applied in the regions where the ratio of the standard deviation to respective quantity's magnitude is greater than unity.

References

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