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The large scale magnetic fields of accretion disks

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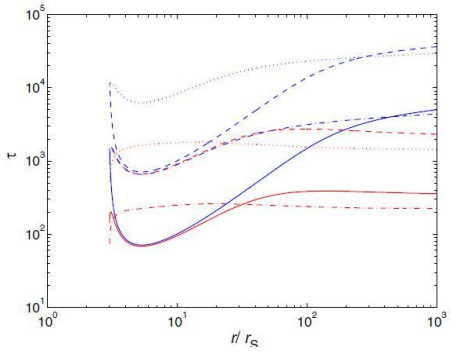
Abstract



Large-scale magnetic field threading an accretion disk is a key ingredient in the jet formation model. The most attractive scenario for the origin of such a large-scale field is the advection of the field by the gas in the accretion disk from the interstellar medium or a companion star. We calculate the advection/diffusion of the large-scale magnetic field threading an advection-dominated accretion flow (ADAF) and find that the magnetic field can be dragged inward by the accretion flow efficiently if the magnetic Prandtl number $P_{\rm m}$=\eta/\nu\sim 1$. However, it is realized that outward diffusion of the accreted field is fast compared with the inward accretion velocity in a geometrically thin accretion disk if the value of the Prandtl number $P_{\rm m}$ is around unity. We revisit this problem considering the angular momentum of the disk to be removed predominantly by the magnetically driven outflows. The radial velocity of the disk is significantly increased due to the presence of the outflows. Using a simplified model for the vertical disk structure, we find that even moderately weak fields can cause sufficient angular momentum loss via a magnetic wind to balance outward diffusion.

All are welcome! Tea, coffee, biscuits will be served at 2:15 P.M.

You are welcome to nominate speakers to Weimin Yuan (wmy@nao.cas.cn, Jan-Mar), Mei Zhang (zhangmei@bao.ac.cn, Apr-Jun), Licai Deng (licai@bao.ac.cn, Jul-Sep), Xuelei Chen (xuelei@cosmology.bao.ac.cn, Oct-Dec), Shude Mao (smao@nao.cas.cn)