Contribution ID: **80** Type: **Talk in a parallel session**

Study of mass outflow rates from magnetized accretion disk around rotating black holes

We develop a framework to study the properties of mass outflows from a relativistic, viscous, magnetized, advective accretion flow around a rotating black hole (BH). While doing so, we assume that the disk is mainly threaded by the toroidal component of magnetic field and consider synchrotron radiation as the main cooling mechanism within the accretion disk. With this, we self consistently solve the coupled accretion-ejection equations and obtain the shock-induced global inflow-outflow solutions in the steady state. Using this model, we estimate mass outflow rate ($R_{\dot{m}}$, the ratio of outflow to inflow mass flux) by varying the model parameters, such as plasma-β (ratio of gas pressure to magnetic pressure), accretion rate ($\dot{m}$), viscosity($\alpha_{\rm B}$) and black hole spin ($a_{\rm k}$). We observe that $R_{\dot{m}}$ increases as the magnetic activity inside the disk is increased. Specifically, we find that a maximum $\sim$ 30% of accreted matter can be ejected for a Kerr black hole ($a_{\rm k} = 0.99$), whereas for Schwarzschild black hole it is $\sim$ 24%. Finally, we discuss the implication of this formalism in explaining the kinetic jet power commonly observed from black hole sources.

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Session Classification: Spectral and temporal properties of accretion flows and jets around compact objects and the theoretical models

Track Classification: Accretion (AC): Spectral and temporal properties of accretion flows and jets around compact objects and the theoretical models