Physics of Plasma Accretion Disks

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In plasma accretion disks from which jets can emerge it is reasonable to consider physical regimes where the magnetic field energy can be of the order of the thermal energy ($\beta \sim 1$).
The axisymmetric magnetic and electric field configurations that can be present in thin disks in different β regimes is discussed. Two-dimensional modes, that can be excited from axisymmetric equilibrium disk configuration have to be of the ballooning kind [1] in the vertical direction and have an intrinsic difficulty in fitting into the height of the disk [2] unless β is relatively large and then have insufficient growth rates to produce the rates of transport of angular momentum that are needed to explain the luminosities of a significant variety of objects. Conversely, bending (tridimensional) modes that are singular when described by the linearized ideal MHD approximation can be excited and lead to substantial outward fluxes of the angular momentum corresponding to significant rates of accretion. However, these modes and their growth rates depend on the nonlinear processes that make the transition across the ideal MHD singularities possible. A broad class of non linear equations that can be suitable for this is identified. The considered modes are localized around the radius where they co-rotate with the disk and the singularities correspond to the radii where the relevant Doppler shifted frequency becomes equal to the slow magnetosonic frequency and to the shear Alfvén wave frequency[1].

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