Simulations of J et Production in Magnetized A ccretion Disk Coronae: A Possible Magnetic Switch Mechanism

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We present the results of mm'40 Ml ID simulations, performed on Caltech/JPL parallel supercomputers, of the coronae of magnetized accretion disks around compact objects. All produce some type of outflow from the disk. Our parameter study investigated the character of the outflow as a function of the strength of the initial poloidal magnetic field and its angle with respect to the disk rotation axis. When the radial component of the field is significant, this outflow takes the form of a collimated jet ejected from the center of the accretion disk. The jet velocity is a strong function of the strength of the initial magnetic field: for Alfven velocities (V. a) below the escape speed (V. esc) the jet velocity is of order V_a, but for V_a only slightly above V_esc, the jet velocity is an order of magnitude or more. greater.

This "magnetic switch" behaves similarly for a broad range of magnetic field polar angle. 1 lowever, when the initial coronal magnetic field is nearly completely dominated by an axial component, the importance of the central jet diminishes and the outflow becomes dominated by a poorly-collimated wind from a broader region of the accretion disk sur face, This wind also appears to exhibit a magnetic switch behavior.

Our results are consistent with both the semi-ana]yljc results of Li, Chiuch, and Begelman (1992) (when suitable relativistic transformations are taken into account) and of Ustyugova et al. (1995), in their respective regions of parameter space. An analysis of the forces driving these phenomena is currently in progress.

The magnetic switch may have. applications to extragalactic radio sources and other objects.