Statistical Theory of Magnetized Accretion Disk Coronae

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OUR GOALS

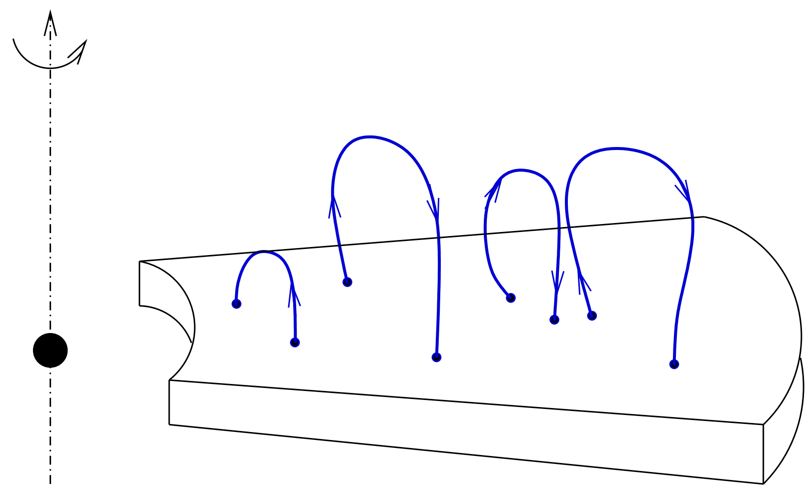
Magnetic interaction between a turbulent accretion disk and its force-free corona.

Questions we want to address:

- How is magnetic energy density $\bar{B}^2(z)/8\pi$ distributed with height z?
- How much **magnetic energy** is pumped into corona?
- How is **magnetic energy dissipation** distributed with height?
- Is there an **inverse cascade** of magnetic loops in the corona? What is the distribution of loops in sizes, field strengths, etc.?
- What fraction of magnetic flux is **open** at any given time?
- How big is **angular momentum transfer** by coronal loops ?
- How do all of these depend on efficiency of **reconnection?**

OUR APPROACH

- **Goal:**
  build a **statistical description** of the coronal magnetic field above a turbulent accretion disk.



- **General Program:**
  - Represent corona by ensemble of magnetic loops, characterized by radial and azimuthal footpoint separations: $(\Delta r, \Delta y)$.
  - Introduce the **Loop Distribution Function** $F(\Delta r, \Delta y)$.
  - Derive the **Loop Kinetic Equation** for F.
  - Obtain a **Statistical Steady State**.

PHYSICS OF THE ADC

Overall, a magnetically-active corona can be described as

A BOILING MAGNETIC FOAM !

Processes governing loop evolution:

- **emergence/submergence** of loops into corona
- stretching by **Keplerian shear**
- **random footpoint walk** due to disk turbulence
- **reconnection** between loops (flares)

Preliminary Results:
Statistical Steady State