Accretion Disk Outbursts: MHD Simulations (Finally) Confront Reality

Accretion disks around compact objects are responsible for some of the most powerful phenomena that we observe in the universe, from gamma-ray bursts to quasars. Stresses in the flow that transport angular momentum outward and allow gravitational binding energy to be released are central to the physics of these flows. For over twenty years, the dominant theoretical paradigm for these stresses is turbulence driven by an instability of weak magnetic fields embedded in the flow. Numerical simulations of this turbulence have revealed much about how these stresses might work, but until recently, they have not successfully explained (never mind predicted) the most significant quantitative observational constraints: the outburst time scales of dwarf novae and low mass X-ray binaries. I will describe recent progress on understanding the behavior of these systems through simulations that incorporate the physics that is essential for exploring the physics of these phenomena.