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Accretion Disks and Jets Around Black Holes

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Some of the most luminous objects in the universe involve accretion disks around black holes. In these systems, gas spirals into the black hole and converts a fraction of its gravitational binding energy into thermal energy and radiation. Sometimes, twin relativistic jets are ejected along the angular momentum axis of the disk. Understanding the physics of black hole accretion disks and jets is a major focus of modern astrophysics. Because the object at the center is a black hole, one must work with a relativistic theory. More importantly, one must allow for the effects of magnetic fields. These play an extremely important role, both in the extraction of angular momentum from the accreting gas – which is what allows the gas to fall into the hole – and in the launching, acceleration and collimation of the relativistic jets. Thus, at a minimum, one must work with the relativistic single-fluid MHD equations. The talk will briefly summarize our current understanding of black hole accretion, and outline some of the major unsolved problems.