Self-similarity and critical collapse in General Relativity and beyond

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ABSTRACT

Critical collapse is an important topic within the broader subject of gravitational collapse. It concerns the behavior of self-gravitating systems at the verge of black hole formation, and is notable for (i) its universality properties, (ii) the emergence of self-similarity, and (iii) for providing potential scenarios for violation of the cosmic censorship conjecture. Traditionally, studies of critical collapse focused on gravity in spherical symmetry, coupled to scalar fields or perfect fluids in order to bypass Birkhoff's theorem. I will discuss how this standard framework extends to cases in which gauge fields are included — possibly also interacting with the scalar fields. Such models arise typically as low-energy string theories. Employing cut-and-paste and dynamical systems techniques, gravitational collapse in this context is studied analytically and allows an assessment of the impact of gauge fields (and their couplings) on critical collapse. In particular, an explicit formula for the so-called critical exponent is obtained.