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Critical Collapse of Radiation Fluids: Deviations from Spherical Symmetry

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We study critical phenomena in the gravitational collapse of a radiation fluid. We perform numerical simulations in both spherical symmetry and axisymmetry, and observe critical scaling in both supercritical evolutions, which lead to the formation of a black hole, and subcritical evolutions, in which case the fluid disperses to infinity and leaves behind flat space. We identify the critical solution in spherically symmetric collapse, and study the approach to this critical solution in the absence of spherical symmetry. Our simulations are performed with an unconstrained evolution code, implemented in spherical polar coordinates, and adopting “moving-puncture” coordinates.

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