

Numerical Relativity: Simulating Black Holes and Neutron Stars (Part 1)

Sunday, 1 March 2026 09:00 (1 hour)

Describing the most compact objects in the Universe requires the use of Einstein's general relativity and solving its field equations. In the presence of matter, these equations must at least be coupled with the equations of general-relativistic hydrodynamics, and the potential inclusion of magnetic fields or neutrino radiation further increases the complexity.

While analytic solutions exist for simple problems under specific symmetry assumptions (e.g., isolated, spherically symmetric black holes or neutron stars), more complex scenarios—such as the merger of compact binaries—require numerical solutions of the general-relativistic field equations. We will discuss some standard methods and provide simplified examples to test these approaches on your own.

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