The State of the Art in Numerical Relativity

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Recent Review Articles


Overview

• Caveats and Apologies
• The Nature of Numerical Relativity
• ADM / 3+1 Formalism
• Initial Value Problem
• New Formalisms for Evolving Einstein’s Equations
• Coordinate Conditions
• Black Hole Excision and Apparent Horizon Location
• Black Hole Evolutions
• Neutron Star Evolutions
• Stable Finite Difference Methods & Adaptive Mesh Refinement Techniques
• Conclusions & Open Issues
Caveats & Apologies

- Will focus on “main stream” numerical relativity, which itself is primarily concerned with the prediction of gravitational waveforms from interactions and collisions of compact objects (black holes (BH) and neutron stars (NS))

- In particular, will not discuss
  - Cosmological solutions (e.g. approaches to the singularity)
  - Nature of black hole interiors, black hole singularities
  - Numerical relativity in higher dimensions (e.g. black strings)
  - Critical phenomena (except briefly in context of adaptive techniques, but see talk by Liebling)