General Relativity and Quantum Cosmology

Properties of Neutron Star Critical Collapses

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Critical phenomena in gravitational collapse opened a new mathematical vista into the theory of general relativity and may ultimately entail fundamental physical implication in observations. However, at present, the dynamics of critical phenomena in gravitational collapse scenarios are still largely unknown. My thesis seeks to understand the properties of the threshold in the solution space of the Einstein field equations between the black hole and neutron star phases, understand the properties of the neutron star critical solution and clarify the implication of these results on realistic astrophysical scenarios. We develop a new set of neutron star-like initial data to establish the universality of the neutron star critical solution and analyze the structure of neutron star and neutron star-like critical collapses via the study of the phase spaces. We also study the different time scales involved in the neutron star critical solution and analyze the properties of the critical index via comparisons between neutron star and neutron star-like initial data. Finally, we explore the boundary of the attraction basin of the neutron star critical solution and its transition to a known set of non-critical fixed points.

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