

Gravitational Collapse: formation of black holes and naked singularities



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Everyone is invited to
attend

ABSTRACT

In this talk, I present an overview of gravitational collapse in general relativity, focusing on the formation of black holes and naked singularities. I begin with trapped surfaces and apparent horizons, and their relation to the focusing of null geodesics through the Raychaudhuri equation. I then review the Penrose and Hawking–Penrose singularity theorems, emphasizing both their implications and their limitations, particularly regarding the causal structure of singularities. I next discuss the cosmic censorship conjecture and compare homogeneous (Oppenheimer–Snyder–Datt) and inhomogeneous (Lemaître–Tolman–Bondi) collapse, illustrating how naked singularities can arise. In particular, I present Christodoulou’s method showing that null geodesics can, in principle, emerge from the central singularity for an open set of initial data in spherically symmetric inhomogeneous dust collapse. Finally, I comment on non-spherical collapse and discuss possible observational signatures that could distinguish naked singularities, should they form as end states of gravitational collapse in nature.

