

Dynamical Horizons and their properties

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Abstract

A detailed description of how black holes grow in full, non-linear general relativity is presented. The starting point is the notion of *dynamical horizons*. Expressions of fluxes of energy and angular momentum carried by gravitational waves across these horizons are obtained. Fluxes are local and the energy flux is positive. Change in the horizon area is related to these fluxes. The flux formulae also give rise to balance laws analogous to the ones obtained by Bondi, Sachs and others at null infinity and provide generalizations of the first and second laws of black hole mechanics. The framework has a potential application to the proof of a stronger version of the Penrose inequality where the apparent horizon area is related to the future limit of Bondi mass.