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The cylinder at spatial infinity and asymptotic charges

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The asymptotic properties of spacetimes play a central role in many aspects of General Relativity (GR). One of the crucial concepts introduced for the realisation of the latter, was the use of conformal compactifications introduced in General Relativity by Roger Penrose [Nobel Prize 2020] to describe in a geometric way the notion of infinity. The formulation that takes Penrose's idea of conformal compactification to its ultimate consequences are the Conformal Einstein Field (CEFE) equations introduced by H. Friedrich in. Although these equations have been available since 1980 the analytical and numerical exploration of spacetimes using the CEFEs is still in its infancy compared with other formulations. An alternative approach to the CEFE that allows to reach a portion of null infinity is the use of hyperboloidal foliation in more standard formulations of the Einstein Field Equations (e.g. Harmonic Gauge, BSSN or Z4). By construction, hyperboloidal foliations reach the null-infinity but stays away from the region close to spatial infinity. The CEFEs on the other hand give access to this region via the construction of the cylinder at spatial infinity. Both methods, hyperboloidal and conformal, grating access to the different asymptotic regions of spacetimes can be exploited for the analysis of global properties of spacetimes. Asymptotic charges defined at null-infinity will be studied.

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