

BMS flux-balance equations as constraints on the gravitational radiation

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Asymptotically flat spacetimes admit infinite dimensional BMS symmetries which complete the Poincare symmetry algebra with super-translation and super-Lorentz generators. We show that each of these symmetries lead to a flux-balance equation at null infinity, which we compute to all orders in the post-Minkowskian expansion in terms of radiative multipole moments. The ten Poincare flux-balance laws generalize the previously known balance equations to all orders in the post-Minkowskian expansion. The rest of BMS balance laws are novel in the literature and impose infinite number of constraints on the gravitational waveforms. We show that the balance equations for quadrupolar super-translation and super-Lorentz generators give non-trivial constraints at 3PN and 2.5PN order, respectively. Our analysis also confirms the surface charge expression for the angular momentum at null infinity derived previously from the sub-leading soft graviton theorem.

Primary authors: Dr COMPERE, Geoffrey (ULB); Dr OLIVERI, Roberto (Czech Academy of Sciences); Dr SERAJ, Ali (ULB)

Presenter: Dr SERAJ, Ali (ULB)

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