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BMS supertranslations and memory in four and higher dimensions

Abstract

We consider the memory effect in even dimensional spacetimes of dimension $d \geq 4$ arising from a burst of gravitational radiation. When $= 4$, the natural frames in the stationary eras before and after the burst differ by the composition of a boost and supertranslation, and this supertranslation characterizes the 'memory effect', i.e. the permanent displacement of test particles near infinity produced by the radiation burst. However, we show that when $d > 4$, this supertranslation and the corresponding memory effect vanish. Consequently, when $d > 4$, it is natural to impose stronger asymptotic conditions at null infinity that reduce the asymptotic symmetry group to the Poincaré group. Conversely, when $d = 4$, the asymptotic symmetry group at null infinity must be taken to be the BMS group.