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On Electromagnetic and Color Memories in Even Dimensions

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Asymptotic symmetries at null infinity do not seem to play a fundamental role in higher dimensions: in constrast with the four-dimensional case, in $D > 4$ it is indeed possible and natural to describe radiative solutions to Maxwell's and Einstein's equations without ever enlarging the asymptotic symmetry group beyond the standard global symmetries. Similarly, memory effects do not show an immediate link with nontrivial symmetries acting asymptotically, thus pointing to their absence in higher dimensions. However, these conclusions seem at odds with the connection asymptotic symmetries and memory effects share with soft theorems, whose validity extends beyond $D = 4$.

We investigate this issue studying memory effects associated to Abelian and non-Abelian radiation getting to null infinity, in arbitrary even spacetime dimensions. Together with classical memories, linear and non-linear, given by permanent kicks in the velocity of probe particles, we also discuss the higher-dimensional counterparts of quantum memory effects, manifesting themselves in modifications of the relative phases describing a configuration of several probes.

Adopting the Lorenz gauge, we illustrate how one can interpret such memory effects as the action of suitable residual symmetries acting near null infinity and propose a strategy for defining infinite-dimensional asymptotic symmetries of Maxwell's theory in any dimension, eiher even and odd.

Primary authors: CAMPOLEONI, Andrea (Université de Mons); HEISSENBERG, Carlo (Nordita, Stockholm); DARIO, Francia (Centro Fermi, Roma Tre University and INFN)

Presenter: HEISSENBERG, Carlo (Nordita, Stockholm)

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