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Decoupling-limit consistency of the generalized SU(2) Proca theory

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We study the consistency of the decoupling limit of the generalized SU(2) Proca theory (GSU2P). Namely, we study the healthiness of those terms whose analysis in the scalar limit was not originally established in the reconstruction of the full theory (see the work by Gallego Cadavid et al. [Phys. Rev. D 102, 104066 (2020)]). Those terms are the parity-violating $\tilde{\mathcal{L}}^1_{4,2}$ and the parity-conserving beyond SU(2) Proca terms $\mathcal{L}^3_{4,2}$ and $\mathcal{L}^4_{4,2}$. Using the 3+1 Arnowitt-Deser-Misner formalism, we write down the kinetic Lagrangian of these terms in the decoupling limit and show that their corresponding kinetic matrices are degenerate. This degeneracy is a necessary condition for the propagation of the right number of degrees of freedom, as required by the primary constraint-enforcing relation. Interestingly, the $\tilde{\mathcal{L}}^1_{4,2}$ term, which is purely non-Abelian, does not contribute to the kinetic Lagrangian of the theory, so its contribution is trivially degenerate. Similarly, but not trivially in these cases, the contributions of the $\mathcal{L}^3_{4,2}$ and $\mathcal{L}^4_{4,2}$ terms to the kinetic Lagrangian turn out to be degenerate as well. The results presented in this paper represent progress in the construction of the fully healthy GSU2P.

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