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Systematically building the generalized Proca and SU(2) Proca theories of gravity and beyond

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To date, different alternative theories of gravity involving Proca and SU(2) Proca fields have been proposed. Unfortunately, the procedure to obtain the relevant terms has not been systematic enough or exhaustive, thus resulting in some missing terms or ambiguity in the process carried out. In this talk, we will show a systematic procedure to build the generalized Proca and SU(2) Proca field theories and beyond in four dimensions. In our approach, we employ all the possible Lorentz-invariant Lagrangian pieces made out of the Proca and SU(2) Proca fields and their first-order derivatives, and find the relevant combinations that propagate only three degrees of freedom and have healthy dynamics for the longitudinal mode. The key step in our procedure is to retain the flat space-time divergences of the currents in the theory during the covariantization process. In the curved space-time theory, some of the retained terms are no longer current divergences so that they induce the new terms that identify the beyond generalized Proca and SU(2) Proca field theories.

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