Beyond Bimetric Theory: Consistent Theories of Multiple Spin-2 Fields

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Abstract:

The mathematical formulations of the fundamental interactions in nature are all expressed in terms of fields classified by their mass and spin. Two of the most successful theories in physics, general relativity and the standard model, can both, in principle, be derived uniquely from fields with fixed mass and spin, guided by theoretical considerations such as consistency. The standard model contains well-understood interactions of particles with spins less than two, while theories involving spins higher than two are generally problematic. Theories of spin-2 fields are much less explored, and specifically, any consistent multiplet structure, crucial for the standard model, is practically unknown. In pursuit of such structures, this thesis delves into theories of multiple spin-2 fields, examining interactions with a focus on couplings that extend beyond bimetric interactions and concentrating on their consistency, field content, and mass spectrum.