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On a four dimensional formulation for dimensionally regulated amplitudes

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We propose a pure four-dimensional formulation (FDF) of the d-dimensional regularization of one-loop scattering amplitudes. In our formulation particles propagating inside the loop are represented by massive internal states regulating the divergences. The latter obey Feynman rules containing multiplicative selection rules which automatically account for the effects of the extra-dimensional regulating terms of the amplitude. The equivalence between the FDF and the Four Dimensional Helicity scheme is discussed. We present explicit representations of the polarization and helicity states of the four-dimensional particles propagating in the loop. They allow for a complete, four-dimensional, unitarity-based construction of d-dimensional amplitudes. Generalized unitarity within the FDF does not require any higher-dimensional extension of the Clifford and the spinor algebra. Finally we show how the FDF allows for the recursive construction of d-dimensional one-loop integrands, generalizing the four-dimensional open-loop approach.

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