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High Energy Physics - Theory

A New Proposal for the Picture Changing Operators in the Minimal Pure Spinor Formalism

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Using a new proposal for the "picture lowering" operators, we compute the tree level scattering amplitude in the minimal pure spinor formalism by performing the integration over the pure spinor space as a multidimensional Cauchy-type integral. The amplitude will be written in terms of the projective pure spinor variables, which turns out to be useful to relate rigorously the minimal and non-minimal versions of the pure spinor formalism. The natural language for relating these formalisms is the Cech-Dolbeault isomorphism. Moreover, the Dolbeault cocycle corresponding to the tree-level scattering amplitude must be evaluated in SO(10)/SU(5) instead of the whole pure spinor space, which means that the origin is removed from this space. Also, the Cech-Dolbeault language plays a key role for proving the invariance of the scattering amplitude under BRST, Lorentz and supersymmetry transformations, as well as the decoupling of unphysical states. We also relate the Green's function for the massless scalar field in ten dimensions to the tree-level scattering amplitude and comment about the scattering amplitude at higher orders. In contrast with the traditional picture lowering operators, with our new proposal the tree level scattering amplitude is independent of the constant spinors introduced to define them and the BRST exact terms decouple without integrating over these constant spinors.

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