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弦對稱及其高能極限

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Abstract

We calculate and identify the counterparts of zero-norm states in the old covariant first quantised (OCFQ) spectrum of open bosonic string in two other quantization schemes of string theory, namely the light-cone DDF zero-norm states and the off-shell BRST zero-norm states (with ghost) in the Witten string field theory (WSFT). In particular, special attention is paid to the inter-particle zero-norm states in all quantization schemes. For the case of the off-shell BRST zero-norm states, we impose the no ghost conditions and recover exactly two types of on-shell zero-norm states in the OCFQ string spectrum for the first few low-lying mass levels. We then show that off-shell gauge transformations of WSFT are identical to the on-shell stringy gauge symmetries generated by two types of zero-norm states in the generalized massive σ-model approach of string theory. The high energy limit of these stringy gauge symmetries was recently used to calculate the proportionality constants, conjectured by Gross, among high energy scattering amplitudes of different string states. Based on these zero-norm state calculations, we have thus related gauge symmetry of WSFT to the high-energy stringy symmetry of Gross.