

Gauge-Gravity Duality under Kaluza-Klein Compactification: From String to Field

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The scattering amplitudes of massive Kaluza-Klein (KK) states of open and closed bosonic strings play an important role in studying the duality between the gauge and gravity theories. We analyze the structure of vertex operators for the KK strings and derive an extended massive KLT-like relation which connects the N -point KK closed-string amplitude to the products of two KK open-string amplitudes at tree level. Taking the zero α' limit, we derive double-copy construction formula of the N -point massive KK graviton amplitude from the sum of proper products of the corresponding KK gauge boson amplitudes. Then, we can obtain the exact tree-level four-point KK gauge boson amplitudes and KK graviton amplitudes via string-based formula, which fully agree with those given by the KK field-theory calculations. Further, the five- and six-point scattering amplitudes of KK states are also listed.

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