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Soft Graviton Emission at High and Low Energies in Yukawa and Scalar Theories

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Abstract

We study corrections to the soft graviton theorem at all loop orders in Yukawa and scalar theories, both in the high energy and low energy regions. It is found that the tree level soft theorem is corrected by matrix elements coupled to the Riemann curvature tensor of linearized gravity. Further corrections appear in the high energy region and we develop a power counting technique to classify all such loop corrections according to their order of magnitude. This leads to the construction of factorized contributions to the soft theorem, to which we apply an analysis analogous to Low's theorem based on the gravitational Ward identity. In this analysis, we emphasize the role played by the external kinematics.

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