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Gravitational form factors in the perturbative limit

The generalized distribution amplitudes (GDAs) have attracted attention in recent years because of their relation with the energy momentum tensor (EMT) form factors (FFs). The GDAs can be experimentally accessed through the study of amplitudes in $\gamma^*\gamma \to M_1M_2$ and $\gamma^* \to M_1M_2\gamma$, where M_1M_2 is a pseudoscalar meson pair such as $\pi\eta$ and $\eta\eta'$. In this paper we calculate these amplitudes in the perturbative limit where the M_1M_2 GDAs are expressed in terms of meson distribution amplitudes which have been constrained in the previous experiments. Our explicit calculation verifies the existence of a new EMT FF that breaks the conservation law of EMT when the hadronic matrix element of the EMT operator is examined for a single quark flavor. In addition, our result shows that the M_1M_2 GDAs are identical in $\gamma^*\gamma \to M_1M_2$ and $\gamma^* \to M_1M_2\gamma$, which confirms the universality of GDAs in the perturbative limit. In future, the GDAs and EMT FFs studied in this paper can be investigated at Belle II. Our study enhances the accessibility to the P-wave GDAs in $\gamma^*\gamma \to M_1M_2$ and $\gamma^* \to M_1M_2\gamma$ and gives a promising way to search for exotic hybrid mesons in the future experiment.

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