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top-quark mass from diphoton mass spectrum

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We calculate the $gg \rightarrow \gamma\gamma$ amplitude by including the $t\bar{t}$ bound-state effects near their mass threshold. In terms of the non-relativistic expansion of the amplitude, the LO contribution is an energy-independent term in the one-loop amplitude. We include the NLO contribution described by the non-relativistic Green function and part of the NNLO contribution. Despite a missing NLO piece which can be accomplished with the two-loop-level amplitude via massive quarks, the shape of the diphoton mass spectrum is predicted with a good accuracy. Thanks to the simple and clean nature of the observable, its experimental measurement can be a direct method to determine the short-distance mass of the top quark at hadron colliders.

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