

An unambiguous test of positivity at lepton colliders

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The diphoton channel at lepton colliders, $e+e-(\mu+\mu-)\rightarrow\gamma\gamma$, has a remarkable feature that the leading new physics contribution comes only from dimension-eight operators. This contribution is subject to a set of positivity bounds, derived from fundamental principles of Quantum Field Theory, such as unitarity, locality and analyticity. These positivity bounds are thus applicable to the most direct observable – the diphoton cross sections. This unique feature provides a clear, robust, and unambiguous test of these principles. We estimate the capability of various future lepton colliders in probing the dimension-eight operators and testing the positivity bounds in this channel. We show that positivity bounds can lift certain degeneracies among the effective operators and significantly change the perspectives of a global analysis. We also perform a combined analysis of the $\gamma\gamma/Z\gamma/ZZ$ processes in the high energy limit and point out the important interplay among them.

Presenter: Dr GU, Jiayin (JGU Mainz)

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