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Non-local Positivity Bounds: islands in Terra Incognita

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The requirement of unitarity and causality in UV lead to significant constraints on low energy EFT known as positivity bounds. While positivity bounds for local QFT have been derived and used widely, we explore the possibility of a non-local UV completion to the low energy EFT. The non-local UV amplitude we propose has the exponential form. We show some of the examples explicitly that satisfy full unitarity and causality, but they are not polynomially bounded. We introduce the dispersion relation that relates low energy EFT and its non-local UV completion. It is found that the resulting bounds can have an overlap with standard local positivity bounds making it not possible to decide whether the given EFT can have only local UV completion. Interestingly, a comparison with causality bounds derived solely from EFT also set a bound for UV theory through dispersion relations.

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