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# Non-minimally coupled inflation with a pre-inflation anamorphic contracting era; 750 GeV resonance as the inflaton: Unitarity violation and why the resonance is a real singlet scalar

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Inflation due to a non-minimally coupled scalar field is in good agreement with the observed value of spectral index and constraints on the tensor-to-scalar ratio. Here we explore the possibility that non-minimally coupled inflation represents the late stage of a Universe which emerges from an early contracting era. We present a model in which the Universe smoothly transitions from an anamorphic contracting era to late-time non-minimally coupled inflation without encountering a singular bounce. This corresponds to a continuous expansion in the Einstein frame throughout. We show that the anamorphic contracting era is able to provide the smooth superhorizon initial conditions necessary for subsequent non-minimally coupled inflation to occur. The model predicts corrections to the non-minimal coupling, kinetic term and potential of non-minimally coupled inflation which can observably increase the spectral index relative to its non-minimally coupled inflation prediction.

The 750 GeV resonance observed by ATLAS and CMS may be explained by a gauge singlet scalar. This would provide an ideal candidate for a gauge singlet scalar alternative to Higgs Inflation, S-inflation. Here we discuss the relevant results of S-inflation in the context of the 750 GeV resonance. In particular, we show that a singlet scalar, if it is real, has a major advantage over the Higgs boson with regard to unitarity violation during inflation. This is because it is possible to restrict the large non-minimal coupling required for inflation, $\xi \sim 10^5$, to the real singlet scalar, with all other scalars having $\xi \sim 1$. In this case the scale of unitarity violation $\Lambda$ is much larger than the inflaton field during inflation. This protects the inflaton effective potential from modification by the new physics or strong coupling which is necessary to restore unitarity, which would otherwise invalidate the perturbative effective potential based on Standard Model physics. This is in contrast to the case of Higgs Inflation or models based on complex singlet scalars, where the unitarity violation scale during inflation is less than or of the order of the inflaton field. Therefore if the 750 GeV resonance is the inflaton, it must be a non-minimally coupled real singlet scalar.

## Summary

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