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Hunting for Inflaton at Colliders

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We consider the non-minimal quartic inflation driven by the $U(1)_X$ Higgs field ϕ in classically conformal $U(1)_X$ extended Standard Model (SM). Since the conformal symmetry is broken radiatively, the $U(1)_X$ gauge boson mass $m_{Z'}$, the $U(1)_X$ gauge coupling g_X , and the inflationary predictions for tensor-to-scalar ratio r are determined by only two free parameters, the inflaton mass m_ϕ and its mixing angle θ with the SM Higgs field. We show that the new FASER experiment at the High-Luminosity LHC (HL-LHC) can detect the inflaton in both cases if the mass is in the range $0.1 \lesssim m_\phi$ [GeV] $\lesssim 4$. We show that the searches for primordial gravitational waves, collider searches for Z' at the LHC, and long-lived particle searches at experiments like FASER are complementary in the hunt for inflation. By performing a comparative study of the metric and Palatini formulations of gravity, we demonstrate that the two formulations are distinguishable.

Mini Symposia (Invited Talks Only)

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