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Explaining Dark Matter through Primordial Black Holes (PBHs) in Horndeski Gravity

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Dark matter remains one of the major open problems in modern cosmology, and PBHs provide a natural and compelling candidate, with the potential to constitute a significant fraction of it. Simultaneously, General Relativity may require modification, particularly in the early universe. In this work, we explore a novel inflationary scenario within Horndeski gravity, focusing on a subclass with a Galileon-type G3(ϕ,X) interaction, which induces an ultra-slow-roll phase near the end of inflation. This phase enhances the scalar power spectrum on small scales, leading to PBH formation, which are able to constitute a substantial part of DM. Our model accommodates standard inflationary potentials, remains consistent with Cosmic Microwave Background constraints, and can potentially generate observable signatures in the form of second-order gravitational waves.

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