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Primordial perturbations in a bouncing Universe with quintessence

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In this work we investigate the features of the primordial power spectrum when it arises from a contracting phase in the context of a bouncing Universe.

We consider a toy model in which the Universe is dominated by a scalar field with an exponential potential, further on referred as the quintessence component. This choice is motivated by known results in the literature showing that such scalar field can behave like dust in the asymptotic past and asymptotic future, implying the generation of an almost scale invariant spectrum for large scale modes, but can also exhibit a dark energy behavior in between.

The dynamical system analysis of the background equations shows that the scalar field experiences an effective equation of state of dark energy type either in the contracting phase or in the expanding phase of a quantum bouncing model, but not in both.

The first scenario is an exercise about how a quintessence field playing the role of dark energy could add new features in the power spectrum if it was present in a contracting phase. The second is closer to realistic cosmological models where dark energy is present in the expanding phase, but is absent in the contracting phase. Both deserve attention, and are first approximations to the development of realistic approaches to address the problem of structure formation in bounce cosmologies with dark energy.

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