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Rollercoaster Cosmology

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Does inflation have to happen all in one go? The answer is a resounding no! All cosmological problems can be solved by a sequence of short bursts of cosmic acceleration, interrupted by short epochs of decelerated expansion. The spectrum of perturbations will still match the CMB and LSS if the earliest stage of the last $\text{calO}(50) - \text{calO}(60)$ e-folds is at least $\text{calO}(15)$ e-folds long. Other stages can be considerably shorter. But as long as they add up to $\text{calO}(50) - \text{calO}(60)$ e-folds and the stages of decelerated expansion in between them are shorter and also overall last less, the ensuing cosmology will pass muster. The presence of the interruptions resets the e-fold clock of each accelerating stage, and changes its value at the CMB pivot point. This change opens up the theory space, loosening the bounds. In particular some models that seem excluded at $\text{calN} = 60$ fit very well as shorter stages with $\text{calN} = 30$. Interesting predictions are that both the scalar and tensor spectra of perturbations are rapidly modified at short wavelengths. In the simplest cases the perturbations are suppressed relative to the perturbations at large scales just because when they freeze out, the background curvature is smaller. The modes which do leave the horizon however will remain frozen as long as the subsequent intervening stages of decelerated expansion remain short. These features could be tested with future CMB spectroscopy searches and with short wavelength primordial gravity probes. The spatial curvature in these models can be larger than the largest wavelength scalar perturbations, because Ω_k evolves differently than the scalar perturbations $\frac{\delta\rho}{\rho}|_s$. Finally, with many short stages of accelerated expansion, the abundance of reheating products from previous accelerated stages does not get completely wiped out. This implies that the universe may contain additional populations of particles, more rare than the visible ones, or even primordial black holes, created during a late decelerated epoch before last reheating, which may be dark matter.

Is this abstract from experiment?

No

Name of experiment and experimental site

N/A

Is the speaker for that presentation defined?

Yes

Details

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Internet talk

Yes

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