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Hunting for new physics in the primordial Universe

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Propositions

accompanying the dissertation “Hunting for new physics in the primordial Universe”

1. The magic of hyperbolic space lies at the heart of α -attractors’ universal predictions.

Chapter 2 of this thesis

2. We should have the courage to dive into UV completions of inflation with unstabilized light fields.

Chapter 3 of this thesis

3. The excursion of the inflaton may provide a way to probe the symmetries and geometries of internal field manifolds.

Chapter 4 of this thesis

4. It was unexpected that the analysis of the “non-attractor to slow-roll” transition would be later adopted by studies of primordial black holes.

Chapter 5 of this thesis

5. Primordial non-Gaussianity might be our ultimate hope for high energy physics.

Arkani-Hamed & Maldacena: arXiv:1503.08043 [hep-th].

6. There are already several versions of effective field theories of inflation, but new approaches are still needed when including extra degrees of freedom.

*Cheung et al: JHEP **03**, 014 (2008); Weinberg: Phys. Rev. D **77**, 123541 (2008);
Senatore & Zaldarriaga: JHEP **04**, 024 (2012).*

7. In cosmology, the vacuum expectation values of quantum fields are typically time-dependent. This makes a big difference when we apply particle physics techniques to cosmology.

*Nicolis & Piazza: JHEP **06**, 025 (2012).*

8. New understanding of cosmological correlators is being formed via modern scattering amplitudes approaches. It will be curious to see what new results can be derived next.

*Arkani-Hamed et al: JHEP **04**, 105 (2020); Pajer et al: arXiv:2007.00027 [hep-th].*

9. While huge particle colliders (*such as a circum-solar one*) are often mentioned in hard-core science fiction as a sign of developed civilizations, it has not been realized that perhaps 21cm-line observatories on the dark side of the moon are more promising for the future of fundamental physics.

Cixin Liu: The Three-body Problem III: Death’s End.

10. Internal spaces have significant importance, not only for the evolution of the Universe, but also for the full development of an individual.

11. For completing this thesis, the last obstacle that shall be overcome is the work-from-home inefficiency caused by the COVID-19 pandemic.

Dong-Gang Wang
Leiden, 27-08-2020