Instabilities and nonlinear interactions of scalar field perturbations in models of cosmological inflation

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one light field drives inflation

other fields are heavy and completely decouple from the low-energy EFT governing inflation

even if displaced from its minimum, the heavy field rolls back performing damped oscillations and does not affect inflation

inflaton direction

extra field stabilized

by large mass >>>> H

Krzysztof Turzynski, Destabilization / inflation

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BUT it is possible that the 'heavy' field 'climbs up' its potential, destabilizing inflation

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`natural motion' of the fields along geodesic lines, which may diverge on negative-curvature field-space manifold alpha-attractors, toroidal compactifications
Krzysztof Turzynski, Destabilization / inflation

S.Renaux-Petel, KT, Phys. Rev. Lett. 2016

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Geometrical destabilization in α -attractors



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- Unstable spectator accelerates the growth of the fluctuations
- The Universe approaches RD regime in a fraction of an efold

Krzysztof Turzynski, Destabilization / inflation

T. Krajewski, KT, M. Wieczorek, 2018

Side note – parametric resonance in single-field inflation

- 52 models of inflation (Encyclopaedia Inflationaris, Martin, Ringeval & Vennin)
- Check for parametric resonance (Floquet instability analysis)
- Run lattice simulations to check efficiency of reheating
- KKLT inflation as the only candidate for efficient reheating



Krzysztof Turzynski, Destabilization / inflation

KT, M. Wieczorek, Phys. Lett. B, 2018

? end of inflation

extra field stabilized by large mass >> H

inflaton direction

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? second phase of inflation ✔



Conclusions

Rich and potentially fruitful research program

Methodology of particle physics is useful for describing the Universe