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## On multifield inflation, adiabaticity, and the speed of sound of the curvature perturbations

Atal, V.

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**Author:** Atal, Vicente

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# Stellingen

Behorend bij het proefschrift “On Adiabaticity, Multifield Inflation and the Speed of Sound of the Curvature Perturbations”

- I - The speed of sound of the inflaton’s perturbations, as well as all the coefficients of the low energy effective expansion, can help us to constrain physics at energies much higher than the inflationary scale (Chapter 2).
- II - The hint of a correlation between the power spectrum and bispectrum that was noticed in the 2013 Cosmic Microwave Background data, seems to disappear in the 2015 data collected by the Planck satellite (Chapter 3).
- III - The spiral embeddings of inflation have two notable characteristics: On the one hand, they are large field models consistent with an EFT expansion, and on the other hand they might allow us to observe the effects of additional heavy fields (Chapter 4).
- IV - Two scales with a technically natural hierarchy can lead to a non-hierarchical spectrum of masses (Chapter 5).
- V - Unjustifiably, one of the most quoted aspects of the history of the Universe is the presence of an initial spacetime singularity. As noted for example by Starobinsky (more than 30 years ago), this singularity cannot be taken for granted.  
*A. Starobinsky: Phys. Lett., **B91**, 99-102, (1980)*
- VI - As noted by A. Adams et al., not every effective theory has a consistent UV completion. This reinforces the importance of searching for inflationary models in string theory or different UV completions.  
*A. Adams et al.: JHEP, **10**, 014, (2006)*

VII - The two-point correlation function of the Cosmic Microwave Background might be said to have been measured with the best possible accuracy (PLANCK *collaboration*). Data that will become available in the coming years will demand a much more refined understanding of the systematics.

*Ade et al.* PLANCK *collaboration*: Astron. Astrophys, **571**, A1 (2014)

VIII - Despite some hints reported e.g. by the ATLAS *collaboration*, there is no hard experimental evidence for the presence of new physics neither in cosmological observables nor accelerators. This might require start thinking about the possibility that Nature will provide no evidence of new physics at high energies.

*Aad et al.* ATLAS *collaboration*: JHEP **12**, 055 (2015)

IX - Accumulation of knowledge and the acquisition of wisdom are two different things. While the western modern culture promotes the former, we should seek for the latter.

X - Scientists should be more politically involved in pointing out the irrationality of the current global economic system.

Vicente Atal  
Leiden, 8-03-2016