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All-sky reconstruction of the primordial scalar potential & implications

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Abstract. An essential quantity required to understand the physics of the early Universe is the primordial scalar potential and its statistics. We present an inexpensive all-sky reconstruction of the potential from CMB temperature data as well as an extension including polarization data. Once explicitly having the potential, its statistics and underlying physics can be directly obtained avoiding expensive CMB analyses.

Keywords. Primordial Density Perturbations, Bayesian Inference, CMB, Power Spectrum

Overview & results

The all-sky reconstruction [Fig. 1, Dorn *et al.* (2015)] of the primordial scalar potential from WMAP temperature data has been achieved by the development of a Bayesian inference method that splits the 3-dim. inverse problem into many, each of them solved by an optimal linear filter [Yadav & Wandelt (2005), Dorn *et al.* (2015)]. Besides the advantage of the method of being computationally fast, caused by the property of being fully parallelizable, it is straightforward to incorporate polarization data, and the calculation of the related 1σ-uncertainty map [Fig. 1, Dorn *et al.* (2015)] has become possible for the first

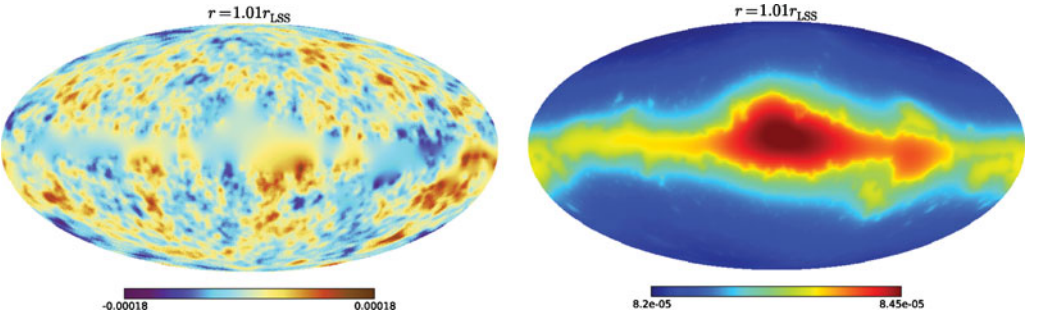

Figure 1. The reconstruction of the primordial scalar potential [left] and its 1σ-uncertainty [right] in the vicinity of the distance to the last scattering surface r_{LSS} [Dorn *et al.* (2015)].

time. Such a reconstruction can directly be used to infer the primordial power spectrum [Dorn *et al.* (2015)] and to perform cross-checks with reconstructions of the initial conditions from large-scale structure [Jasche & Wandelt (2013)]. Furthermore it enables to constrain parameters important for the epochs of the early universe like inflation, reheating, or primordial magnetogenesis. In particular the level of primordial non-Gaussianity, generated by inflation, might be studied.

References

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