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Planck 2015 results: IX. Diffuse component separation: CMB maps

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Abstract

© ESO, 2016.We present foreground-reduced cosmic microwave background (CMB) maps derived from the full Planck data set in both temperature and polarization. Compared to the corresponding Planck 2013 temperature sky maps, the total data volume is larger by a factor of 3.2 for frequencies between 30 and 70 GHz, and by 1.9 for frequencies between 100 and 857 GHz. In addition, systematic errors in the forms of temperature-to-polarization leakage, analogue-to-digital conversion uncertainties, and very long time constant errors have been dramatically reduced, to the extent that the cosmological polarization signal may now be robustly recovered on angular scales â"" µ 40. On the very largest scales, instrumental systematic residuals are still non-negligible compared to the expected cosmological signal, and modes with â"" < 20 are accordingly suppressed in the current polarization maps by high-pass filtering. As in 2013, four different CMB component separation algorithms are applied to these observations, providing a measure of stability with respect to algorithmic and modelling choices. The resulting polarization maps have rms instrumental noise ranging between 0.21 and 0.27µK averaged over 55′ pixels, and between 4.5 and 6.1µK averaged over \hbox{$3\parcm4$} pixels. The cosmological parameters derived from the analysis of temperature power spectra are in agreement at the 1σ level with the Planck 2015 likelihood. Unresolved mismatches between the noise properties of the data and simulations prevent a satisfactory description of the higher-order statistical properties of the polarization maps. Thus, the primary applications of these polarization maps are those that do not require massive simulations for accurate estimation of uncertainties, for instance estimation of cross-spectra and cross-correlations, or stacking analyses. However, the amplitude of primordial non-Gaussianity is consistent with zero within 2σ for all local, equilateral, and orthogonal configurations of the bispectrum, including for polarization E-modes. Moreover, excellent agreement is found regarding the lensing B-mode power spectrum, both internally among the various component separation codes and with the best-fit Planck 2015 Λ cold dark matter model.

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Keywords

Cosmic background radiation, Cosmology: observations, Diffuse radiation, Polarization