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First constraints on the intrinsic CMB dipole and our velocity with Doppler and aberration

Thursday 25 August 2022 16:50 (20 minutes)

We test the usual hypothesis that the Cosmic Microwave Background (CMB) dipole, its largest anisotropy, is due to our peculiar velocity with respect to the Hubble flow by measuring independently the Doppler and aberration effects on the CMB using Planck 2018 data. We remove the spurious contributions from the conversion of intensity into temperature and arrive at measurements which are independent from the CMB dipole itself for both temperature and polarization maps and both SMICA and NILC component-separation methods. Combining these new measurements with the dipole one we get the first constraints on the intrinsic CMB dipole. Assuming a standard dipolar lensing contribution we can put an upper limit on the intrinsic amplitude: 3.7 mK (95% CI). We estimate the peculiar velocity of the solar system without assuming a negligible intrinsic dipole contribution: v=(300+111−93) km/s with (l,b)=(276±33,51±19)◦ [SMICA], and v=(296+111−88) km/s with (l,b)=(280±33,50±20)◦ [NILC] with negligible systematic contributions. These values are consistent with the peculiar velocity hypothesis of the dipole.

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