WMAP 5-year Distance Prior for the Baryon Acoustic Oscillation Data

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WMAP Distance Prior for BAO Analysis

We provide an extended WMAP 5-year distance prior which includes the sound horizon scale for matter perturbations, i.e., the sound horizon scale that determines the phases of the Baryon Acoustic Oscillations (BAO). To implement this prior, follow the steps described in Sec. 5.4.1 of Komatsu et al., ApJS, 180, 330 (2009) with the new vectors and inverse covariance matrix given below.

The new theory vector is:

$$x_i = [l_A(z_*),\ R(z_*),\ z_*,\ r_s(z_d),\ z_d],$$

where z_* is the photon decoupling epoch given by equation (66) of Komatsu et al., $l_A(z_*)$ the acoustic scale given by equation (65), $R(z_*)$ the shift parameter given by equation (69), z_d the redshift of the baryon drag epoch given by equation (3), and $r_s(z_d)$ is the sound horizon at the drag epoch given by equation (6) with $z = z_d$.

The new data vector is:

$$\begin{aligned} d_i &= [l_A^{WMAP}(z_*),\ R^{WMAP}(z_*),\ z_*^{WMAP},\ r_s^{WMAP}(z_d),\ z_d^{WMAP}] \\ &= [302.10,\ 1.710,\ 1090.04,\ 153.562,\ 1020.53]. \end{aligned}$$

Note that $r_s(z_d)$ is in units of Mpc (*not* in h^{-1} Mpc).

The inverse covariance matrix, $(C^{-1})_{ij}$, for these vectors is:

$$C^{-1} = \begin{pmatrix} 125.16445 & -21566.21066 & 586.73929 & 52.62628 & 339.21769 \\ -21566.21066 & 3785597.13249 & -102870.38199 & -9139.85864 & -59271.86404 \\ 586.73929 & -102870.38199 & 4143.63621 & 1056.12281 & 2801.18444 \\ 52.62628 & -9139.85864 & 1056.12281 & 506.62148 & 856.98949 \\ 339.21769 & -59271.86404 & 2801.18444 & 856.98949 & 1980.61580 \end{pmatrix},$$

which gives χ^2_{WMAP} as

$$\chi^2_{WMAP} = (x_i - d_i)(C^{-1})_{ij}(x_j - d_j).$$