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Constraining beyond ΛCDM models with 21cm intensity mapping forecast ob- servations combined with latest CMB data

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We explore constraints on dark energy and modified gravity with forecast 21cm inten- sity mapping measurements using the Effective Field Theory approach. We construct a realistic mock data set forecasting a low redshift 21cm signal power spectrum P21(k) measurement from the MeerKAT radio-telescope. We compute constraints on cosmological and model parameters through Monte Carlo Markov chain techniques, testing both the constraining power of P21(k) alone and its effect when combined with the latest Planck 2018 CMB data. We complement our anal- ysis by testing the effects of tomography from an ideal mock data set of observations in multiple redshift bins. We conduct our analysis numerically with the codes EFTCAMB/EFTCosmoMC, which we extend by implementing a likelihood module fully integrated with original codes. We find that adding P21(k) to CMB data provides significantly tighter constraints on Ωch2 and H0, with a reduction of the error with respect to Planck results at the level of more than 60%. For the parameters describing beyond ΛCDM theories, we observe a reduction in the error with respect to the Planck constraints at the level of less than 10%. The improvement increases up to almost 35% when we constrain the parameters using ideal, tomographic mock observations. We conclude that the power spectrum of the 21cm signal is sensitive to variations of the parameters describing the examined beyond ΛCDM models and, thus, P21(k) observations could help to constrain dark energy. The constraining power on such theories is improved significantly by tomography.

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