AY15206 Cosmology: Final Project

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1 CMB Temperature Power Spectrum when $w = -1$

Table.1 lists the best-fit flat ΛCDM parameters favored by Planck. Based on these parameters, using CAMB, the Cosmological Microwave Background (CMB) temperaure spectrum with varying dark enquation of state w can be computed[1].
With the cosmological constant equation of state $w = -1$, the CMB TT spectrum is depicted in Figure.1.1 and the CMB EE & TE spectrum in Figure.1.2.

Table 1: Cosmological Parameters Used in the Analysis

Parameter	Value	Defination
$\Omega_m h^2$	0.143	Total matter desity today (inc. massive neutrinos)
$\Omega_b h^2$	0.0221	Baryon density today
$\ln(10^{10} A_s)$	3.04	Log power of the primordial curvature perturbations
τ	0.052	Thomson scattering optical depth due to reionization
n_s	0.963	Scalar spectrum power-law index
h	0.669	Current expansion rate Hubble constant $H_0 = 100h$ km s^{-1} Mpc^{-1}

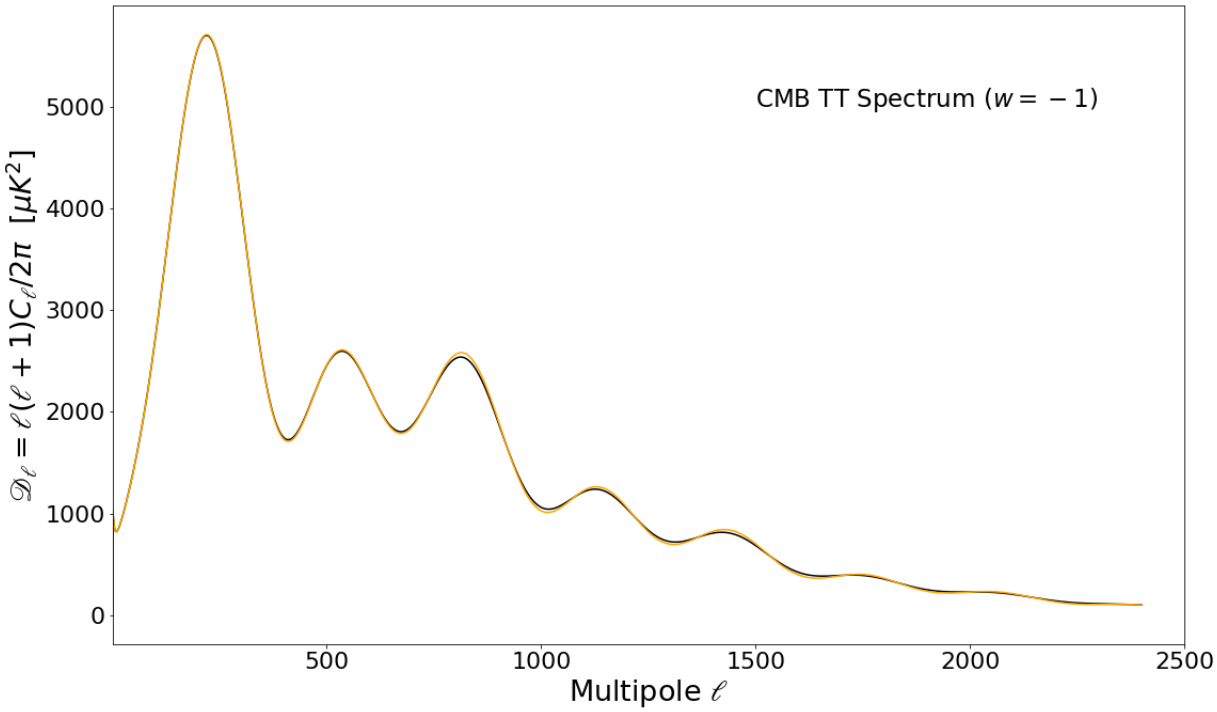

Figure 1.1: CMB Temperature Power Spectrum - TT Mode (The base parameters are listed in Table.1)

[1] The program used to do all the calculation and plots in this project is stored in https://github.com/jasminelujia/AY15206CosmoFinal/blob/master/CMB-Temp-Power-Spectra-varying-w-latest.ipynb.

2 CMB Temperature Power Spectrum when $w = -1.5$

Figure.2.1 is the CMB TT spectrum computed using CAMB based on the paramers in Table.1 with the cosmological constant equation of state $w = -1.5$, and Figure.2.2 the CMB EE & TE spectrum.

3 CMB Temperature Power Spectrum when $w = -0.5$

Figure.3.1 is the CMB TT spectrum computed using CAMB based on the paramers in Table.1 with the cosmological constant equation of state $w = -0.5$ and Figure.3.2 the CMB EE & TE spectrum.

4 Analysis of the Differences between different CMB Power Spectra

Figure.4.1 is the CMB TT spectra with 3 different dark energy equation of state and Figure 4.2 the CMB EE & TE spectrum.

Both Figure.4.1 and 4.2 show that the chaning of w would induces shifts in the spectrum.

When switching the value of w from -1 to -1.5, the spectrum slightly moves to larger angular scales, but the heights of the peaks of the spectrum nearly stay the same.

When switching the value of w from -1 to -0.5, the spectrum moves to smaller angular scales, and the heights of the peaks become slightly higher.

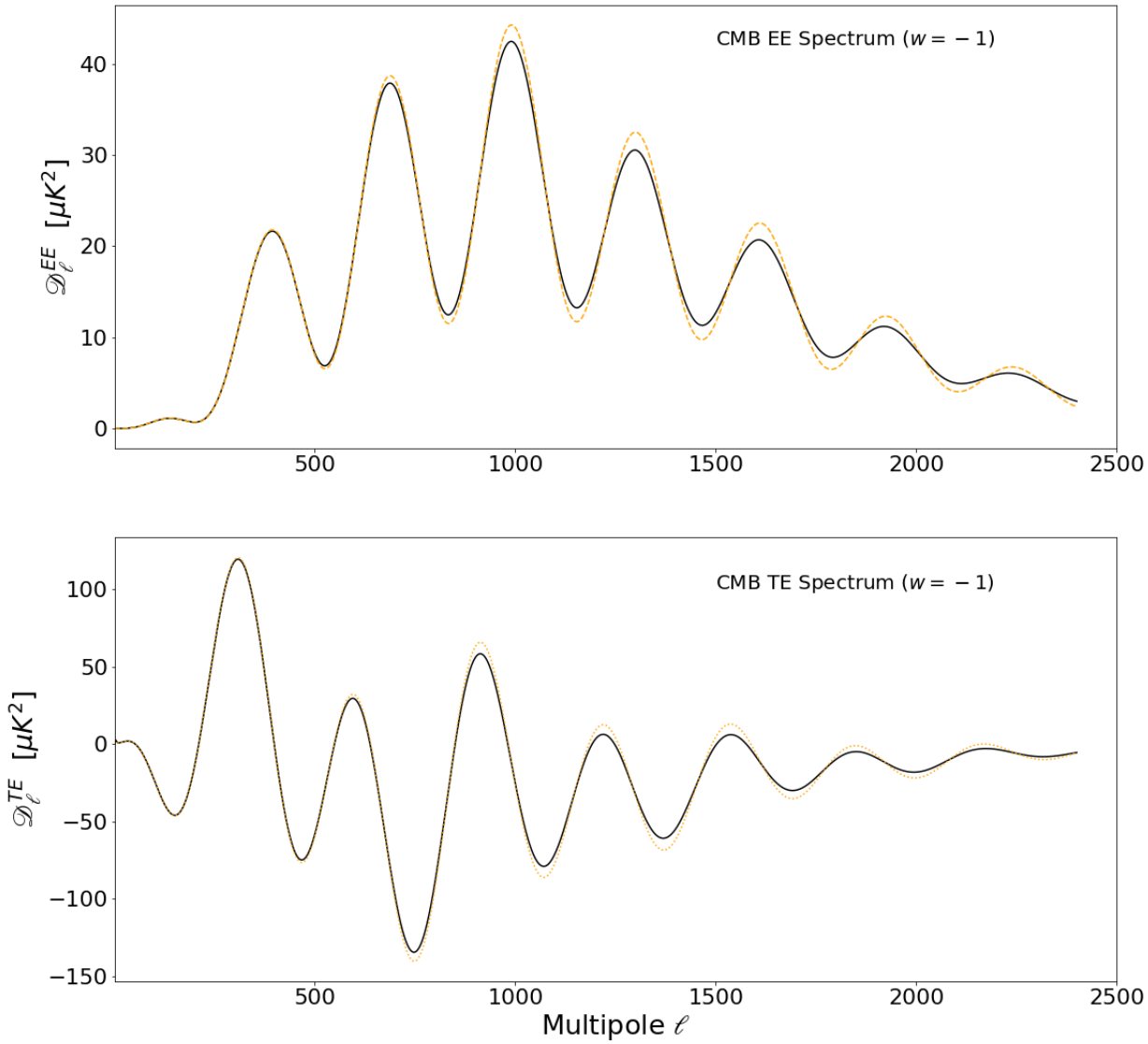

Figure 1.2: CMB Temperature Power Spectrum - TE (upper) and EE (bottom) Modes
(The base parameters are listed in Table.1)

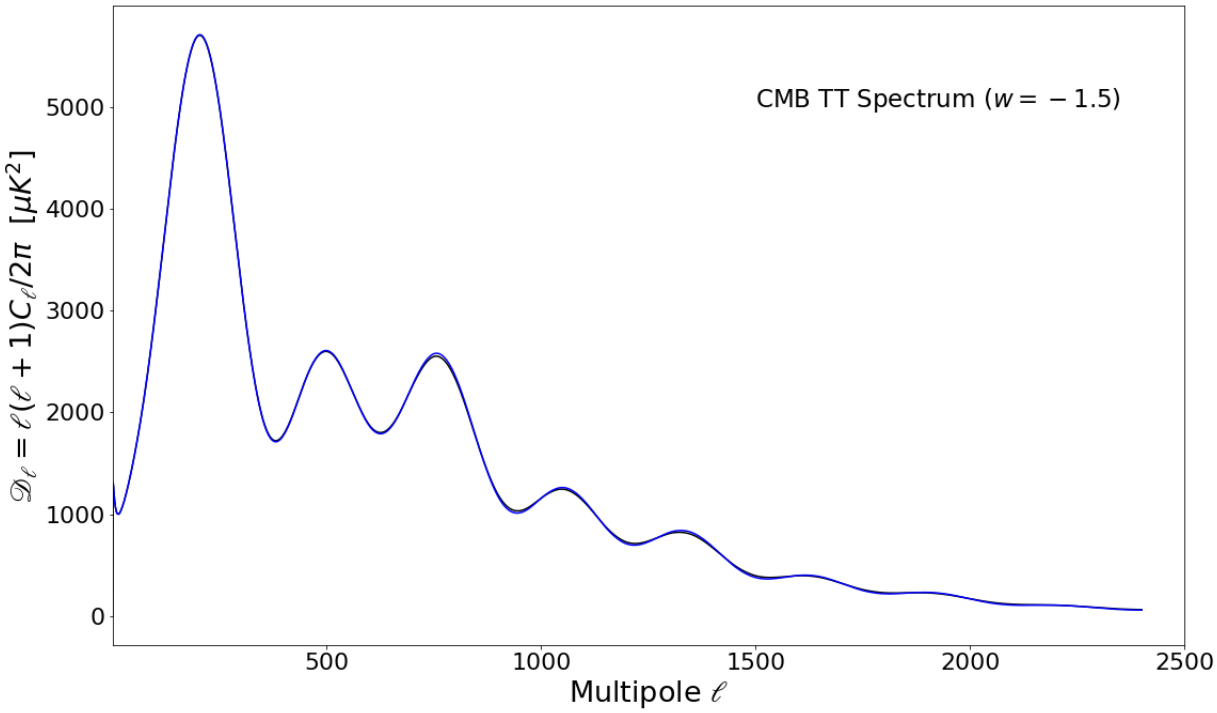

Figure 2.1: CMB Temperature Power Spectrum - TT Mode (The base parameters are listed in Table.1)

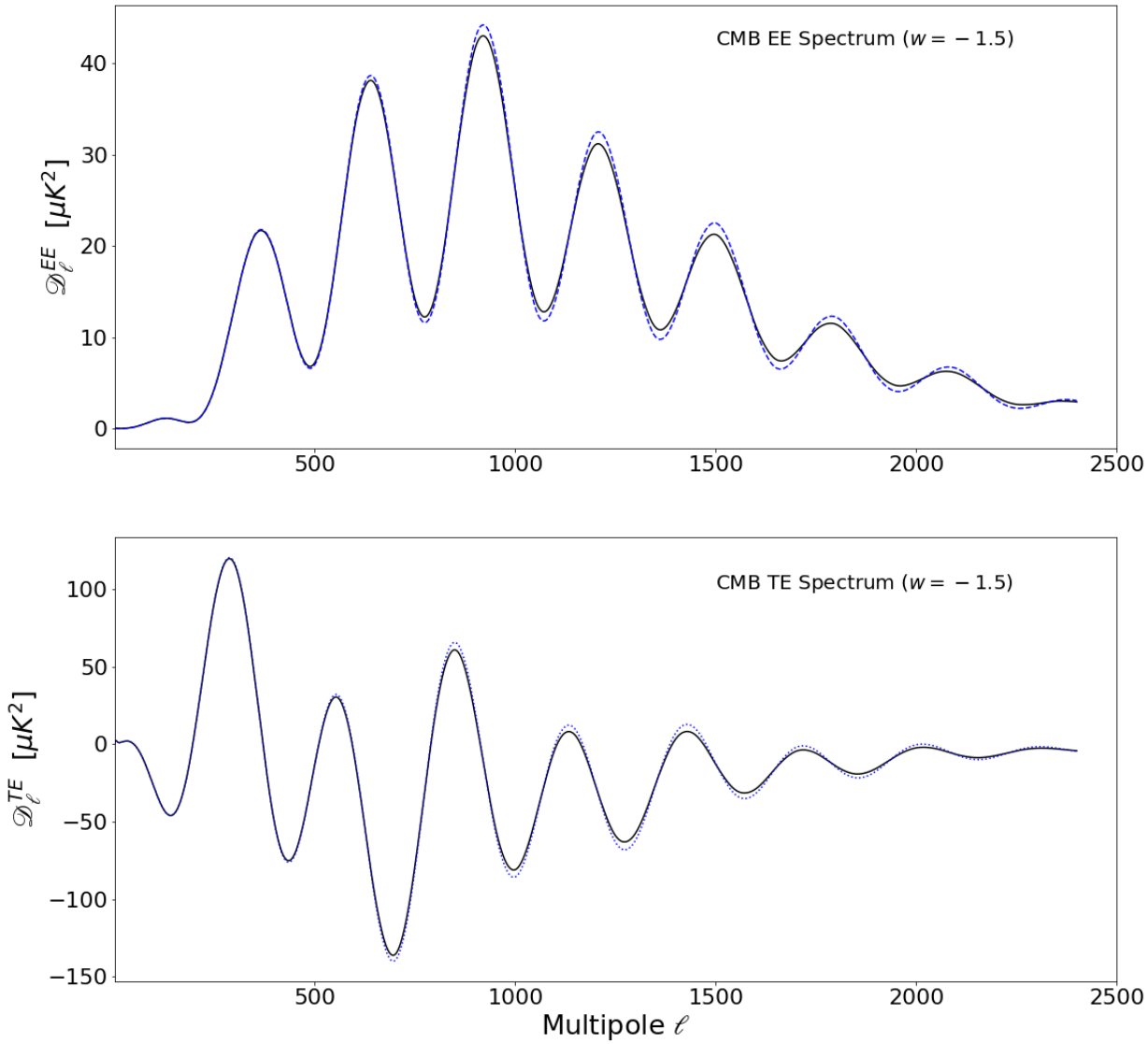

Figure 2.2: CMB Temperature Power Spectrum - TE (upper) and EE (bottom) Modes
(The base parameters are listed in Table.1)

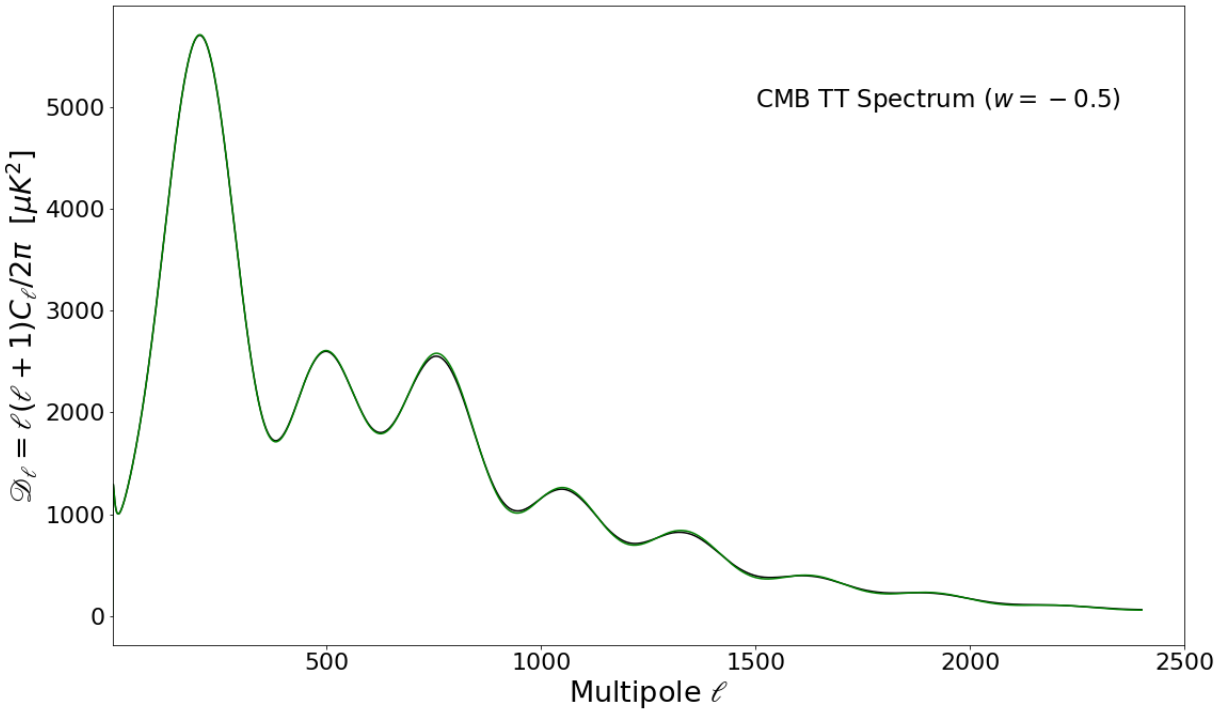

Figure 3.1: CMB Temperature Power Spectrum - TT Mode (The base parameters are listed in Table.1)

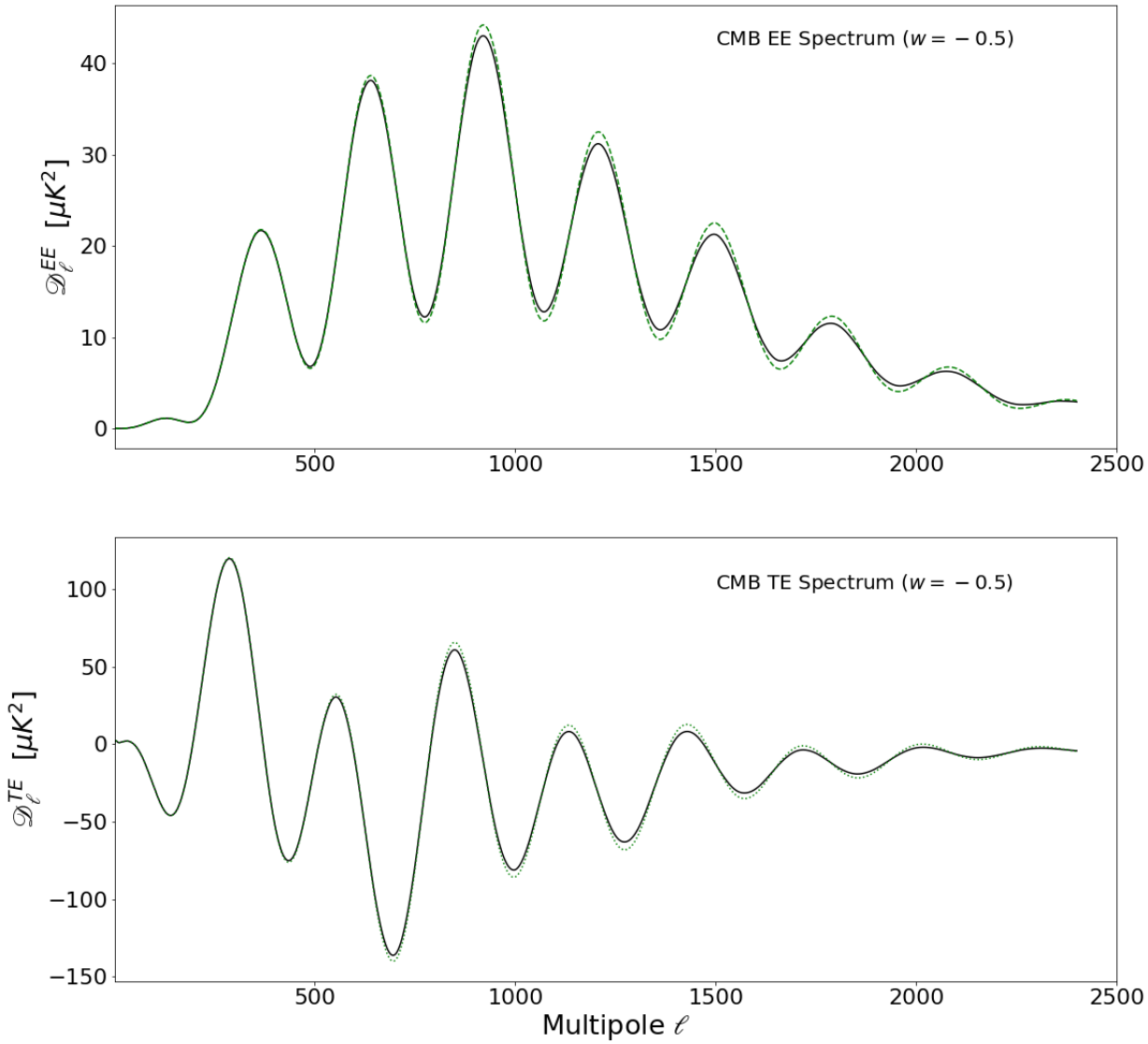

Figure 3.2: CMB Temperature Power Spectrum - TE (upper) and EE (bottom) Modes
(The base parameters are listed in Table.1

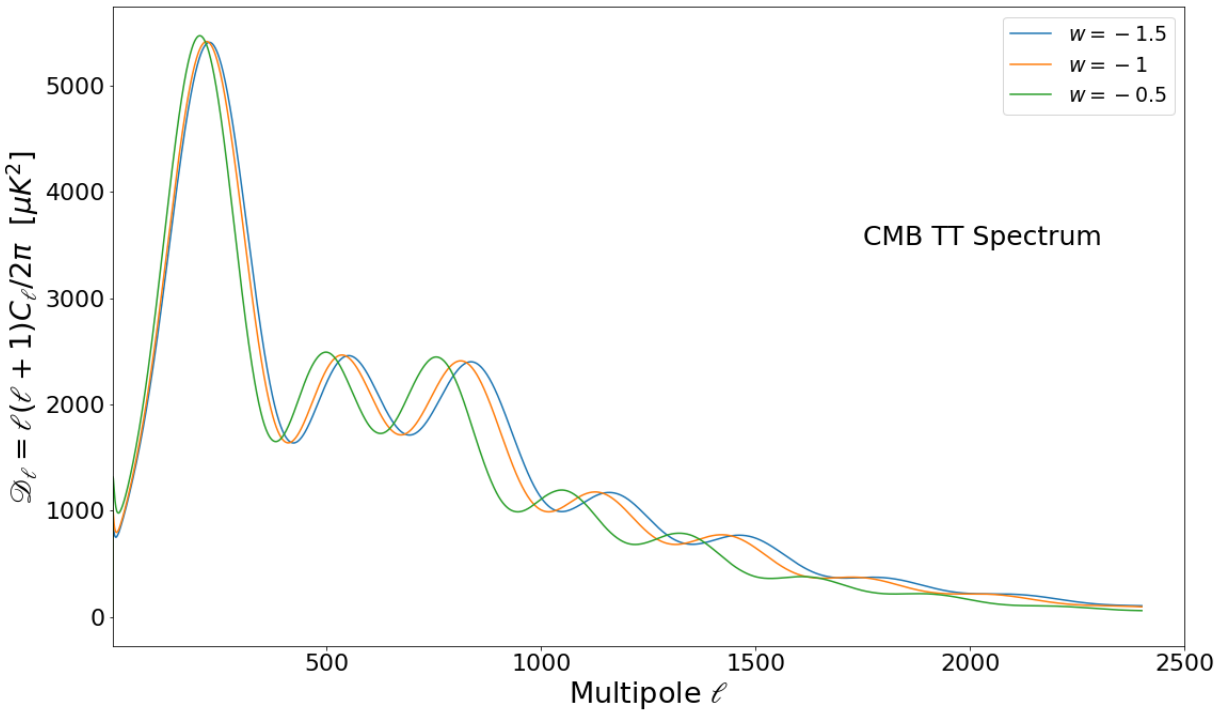

Figure 4.1: CMB Temperature Power Spectrum - TT Mode with Different Dark Energy Equation of State (The base parameters are listed in Table.1

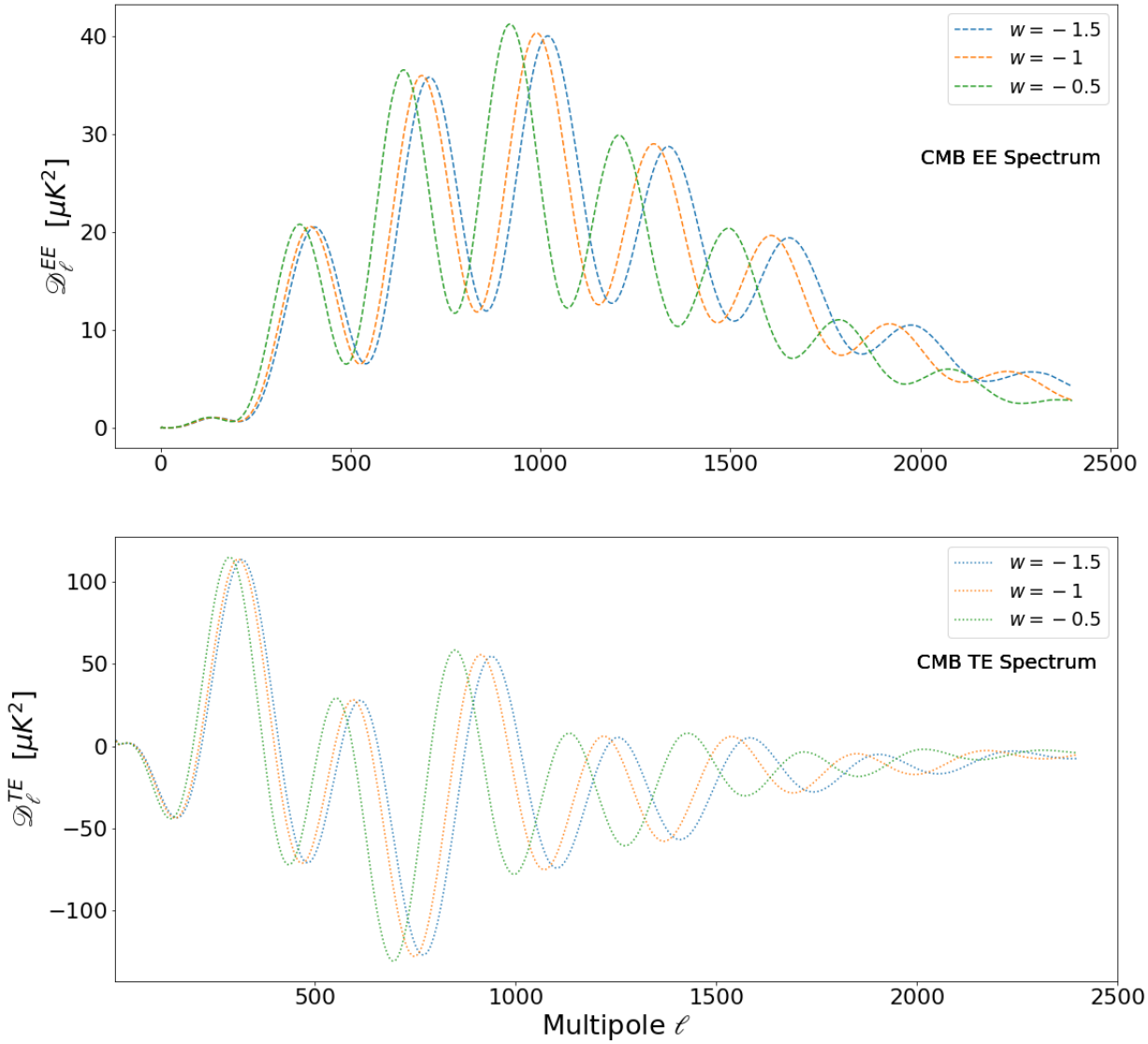

Figure 4.2: CMB Temperature Power Spectrum - TE (upper) and EE (bottom) Modes with Different Dark Energy Equation of State (The base parameters are listed in Table.1