

# PGF5299: Physical Cosmology II

## Problem Set 2

(Due September 17, 2021)

**1) CMB Power Spectrum.** Use CAMB to generate the CMB  $C_l$ 's. Make plots of  $C_l$  versus  $l$ , changing the cosmological parameters one at a time, and explain the effects you see on the spectrum. Vary the following parameters:

$\Omega_m$ : matter density

$T_\gamma$ : photon temperature (or similarly its density  $\Omega_\gamma$ )

$\Omega_b$ : baryon density

$\Omega_{\text{DE}}$ : dark energy density

$\Omega_k$ : curvature density

$w$ : dark energy equation of state

$h$ : Hubble constant

$N_{\text{eff}}$ : effective number of massless neutrino species

$A_s$ : spectral amplitude of primordial scalar perturbations

$n_s$ : spectral index of primordial scalar perturbations

$\tau$ : optical depth