



## INTRODUCTION TO COSMOLOGY - PART 3

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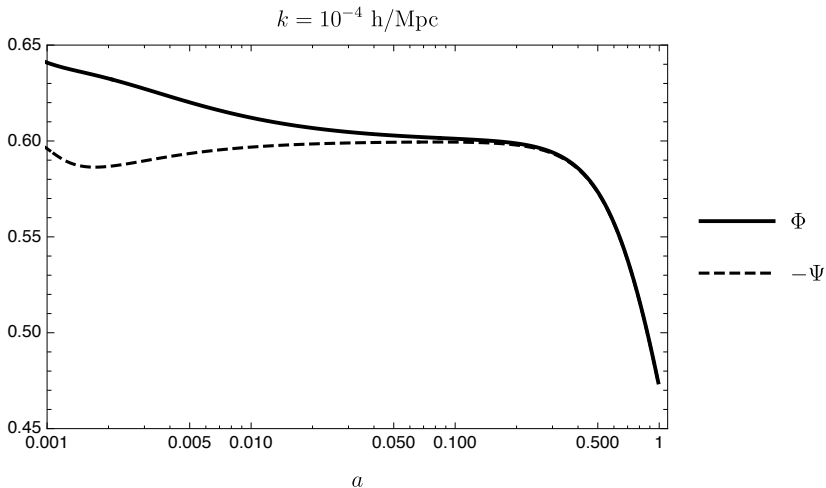
Estate Quantistica 2024

# OUTLINE

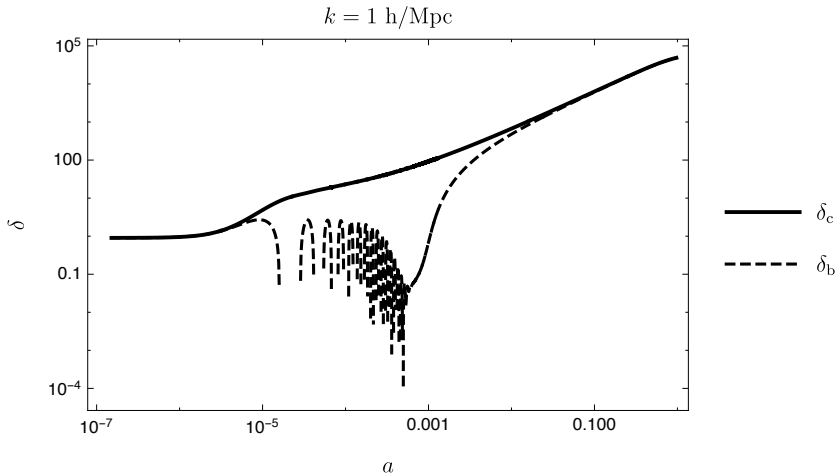
## 1 COSMOLOGICAL EVOLUTIONS

## Cosmological Evolutions and sensitivity to the cosmological parameters

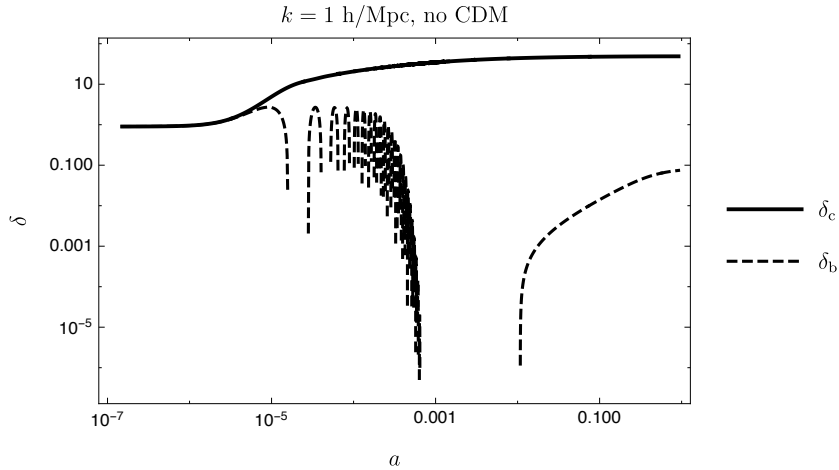
# TWO GRAVITATIONAL POTENTIALS



# BARYONS FALLING IN THE CDM POTENTIAL WELLS

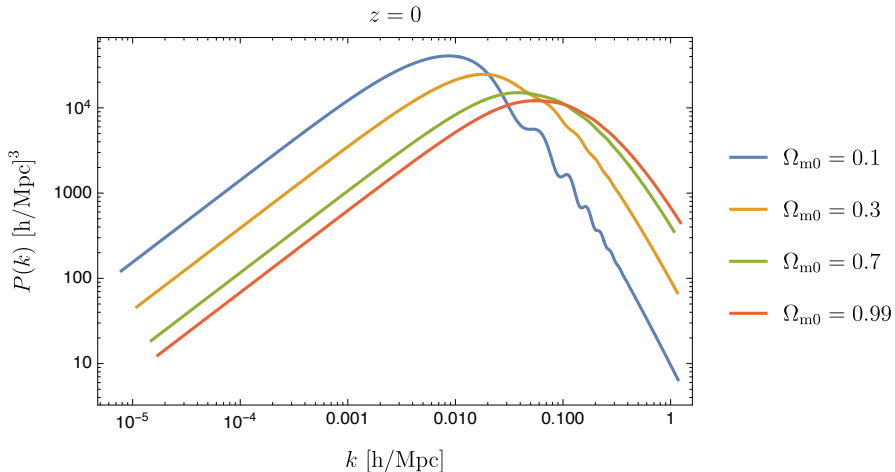


# BARYONS FALLING IN THE CDM POTENTIAL WELLS



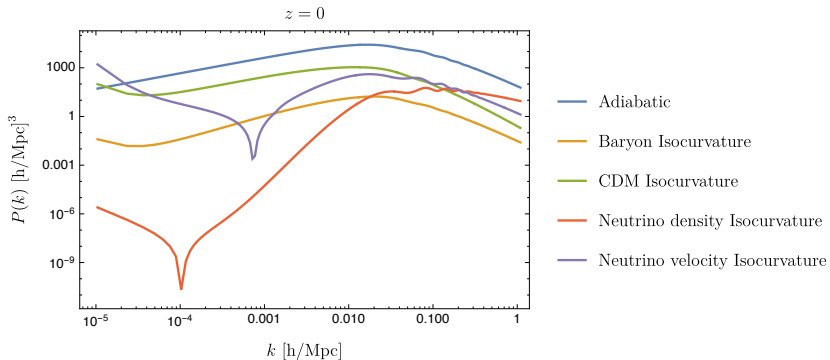
# POWER SPECTRA

## NECESSITY FOR $\Lambda$



# POWER SPECTRA

## DIFFERENT INITIAL CONDITIONS





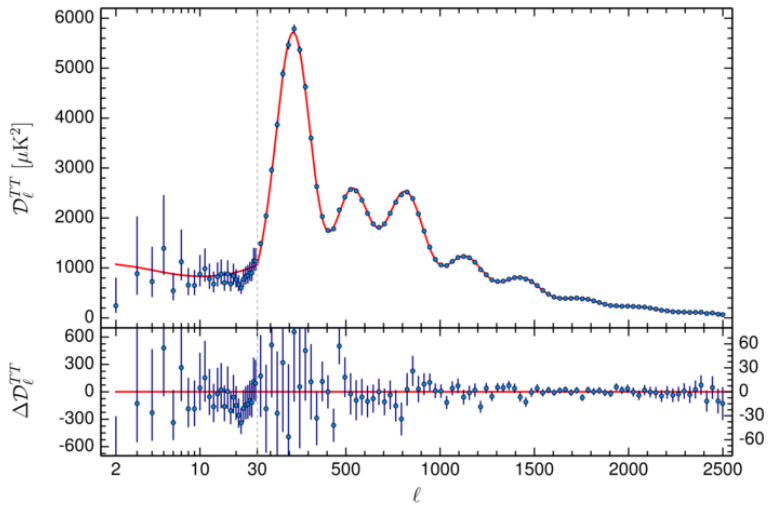
# CMB POWER SPECTRA

For the standard  $\Lambda$  model, 6 of the overall parameters are usually left free and constrained by observation:

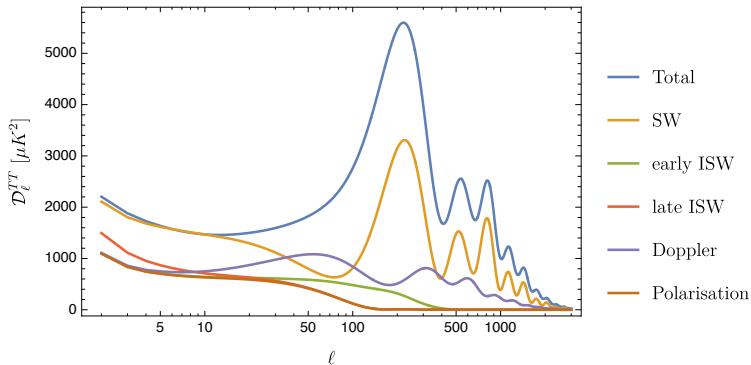
- 1 The amplitude of the primordial power spectrum:  $A_S$ ;
- 2 The primordial tilt:  $n_S$ ;
- 3 The baryonic abundance:  $\Omega_{b0} h^2$ ;
- 4 The CDM abundance:  $\Omega_{c0} h^2$ ;
- 5 The reionization epoch:  $z_{\text{reion}}$ ;
- 6 The sound horizon at recombination:  $r_s(\eta_*)$ , which is related to the Hubble constant value  $H_0$ .

The other parameters can be derived by these ones. In particular, the amount of radiation is already well known by measuring the CMB temperature and so the amount of  $\Lambda$  and curvature is determined via the positions of the peaks, which depend on  $r_s(\eta_*)$ , which in turn depends on the baryon content.

# CMB TT POWER SPECTRUM

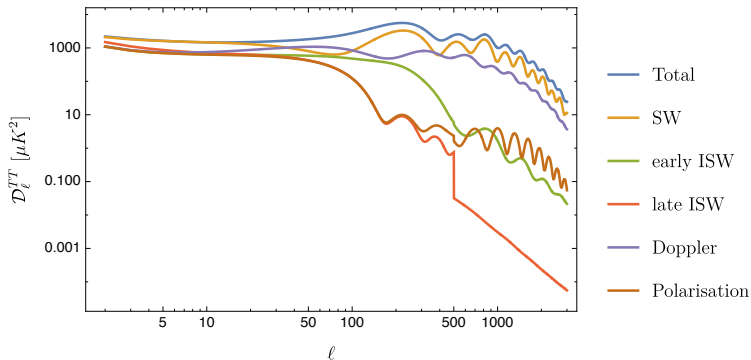


# CMB TT POWER SPECTRUM DECOMPOSITION



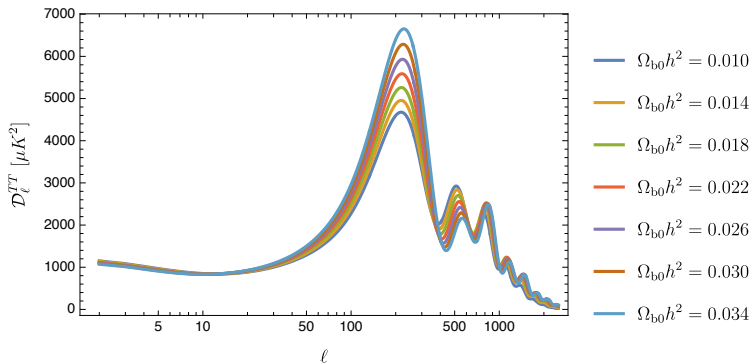
# CMB TT POWER SPECTRUM

## DECOMPOSITION IN LOG-LOG SCALE



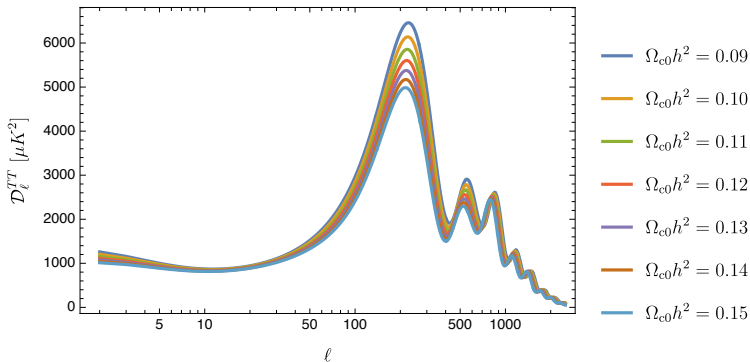
# CMB TT POWER SPECTRUM

## VARYING THE BARYON CONTENT



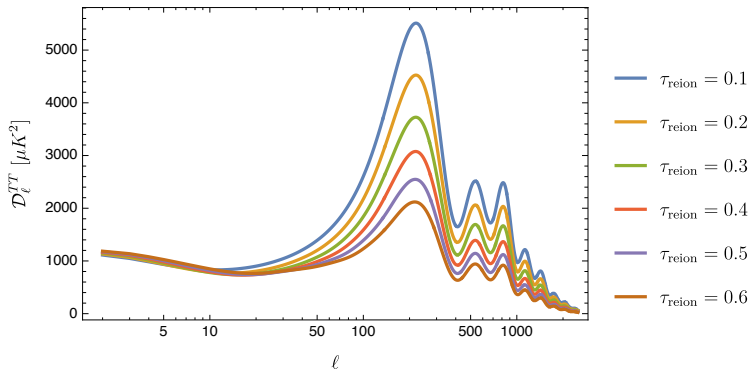
# CMB TT POWER SPECTRUM

## VARYING THE CDM CONTENT



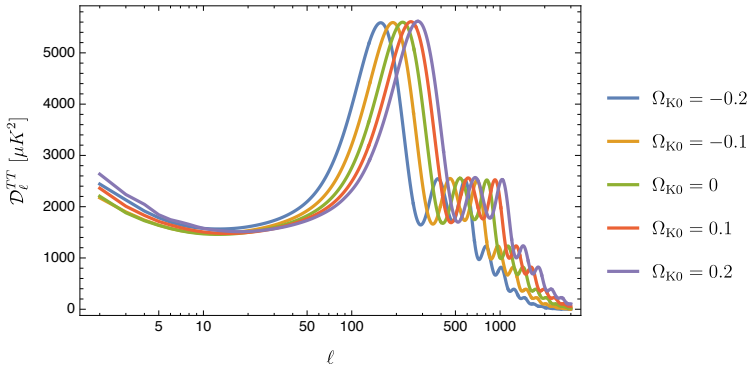
# CMB TT POWER SPECTRUM

## VARYING THE REIONIZATION EPOCH



# CMB TT POWER SPECTRUM

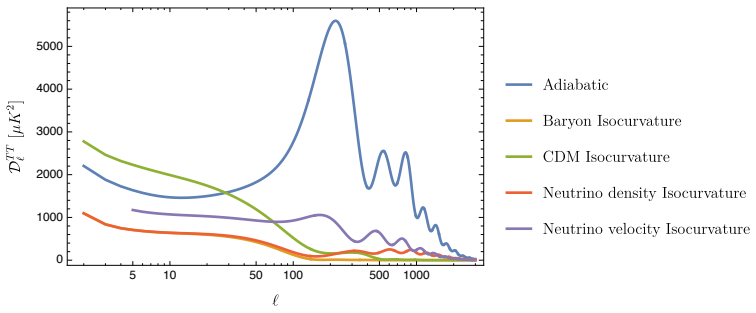
## VARYING THE SPATIAL CURVATURE





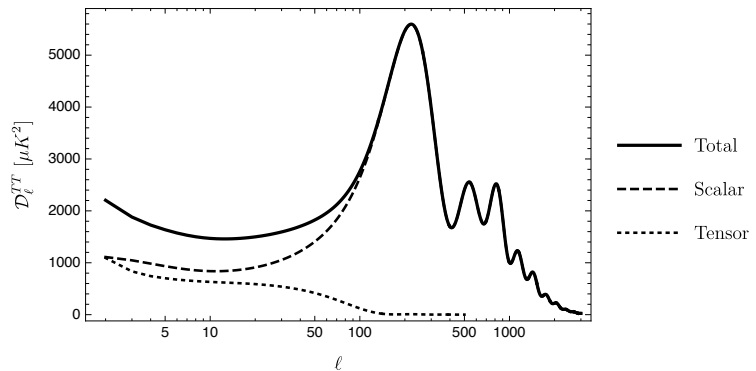
# CMB TT POWER SPECTRUM

## VARYING THE INITIAL CONDITIONS



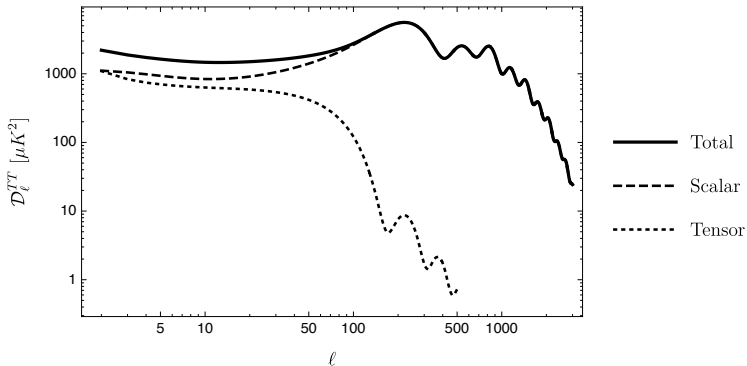
# CMB TT POWER SPECTRUM

## TENSOR AND SCALAR CONTRIBUTIONS



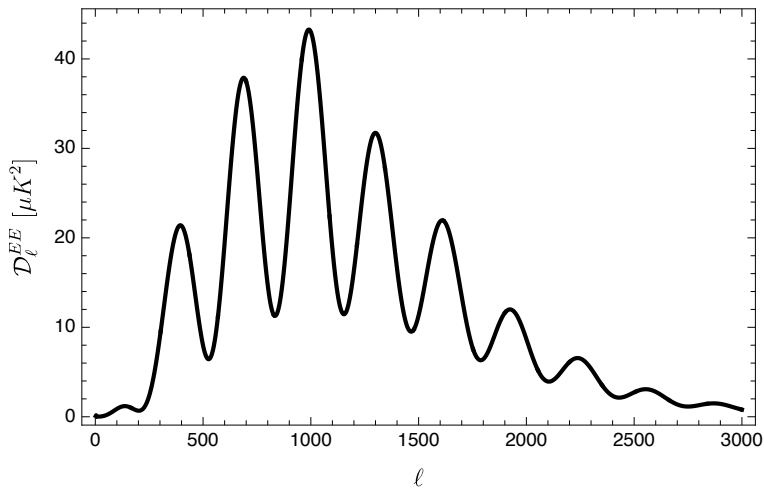
# CMB TT POWER SPECTRUM

## TENSOR AND SCALAR CONTRIBUTIONS IN LOG-LOG SCALE



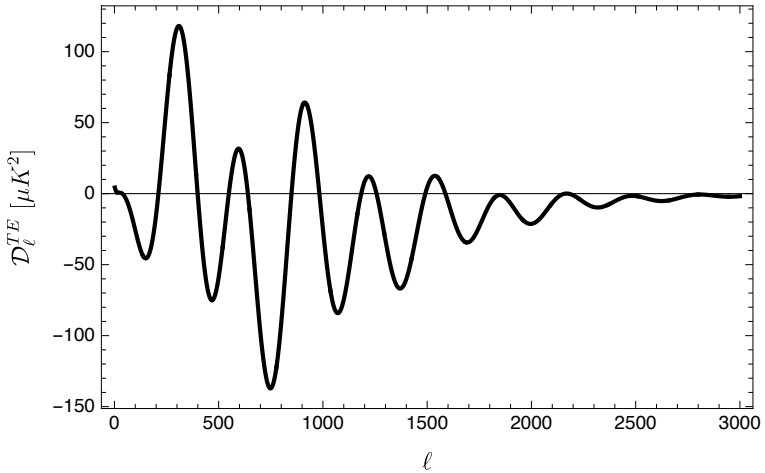
# POLARIZATION SPECTRA

## EE



# POLARIZATION SPECTRA

## TE



# POLARIZATION SPECTRA

## BB

