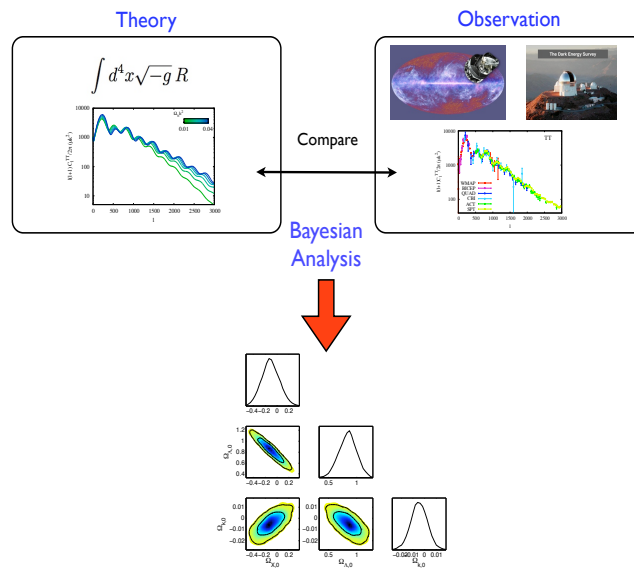


Updated Cosmology

with Python



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In progress

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Homework 1

HW 1.1.a: Covert the following quantities:

- $T_0 = 2.725 K \rightarrow 0.2348 \text{ meV}$, CMB temperature today.
- $\rho_{\gamma,0} = 4\sigma T_0^4/c \rightarrow 0.260 \text{ eV cm}^{-3}$ (411γ 's cm^{-3}), CMB energy density.
- $c/H_0 \rightarrow \text{Mpc}$, with $H_0 = 70 \text{ km sec}^{-1} \text{Mpc}^{-1}$, Radius of the observable universe.

HW 1.1.b: Show the equivalence:

- $4.48162009 \times 10^{-7} = \text{see box below}$.
- $0.2776566337 = 45 * \zeta(3)/(2 * \pi^4)$.
- $\rho_{c,0} = 1.87840 h^2 \times 10^{-26} \text{ kg m}^{-3} = 2.775 h^{-1} \times 10^{11} M_{\odot}/(h^{-1} \text{Mpc})^3$.

type it into google:

```
8*pi^5*(boltzmann constant)^4/(15*(h*c)^3)*(1 Kelvin)**4/(3*(100 km/s/Mpc)^2/(8*Pi*G)*(speed of light)^2)
```

HW 1.3: Compute the orbital speed of Neptune (5.43 km/s) given the mass of the sun and its distance, and compare with the real measurements (see Figure 1.7). Do the same with the Milky Way and the Sun.

1. NOTATION AND CONVENTIONS

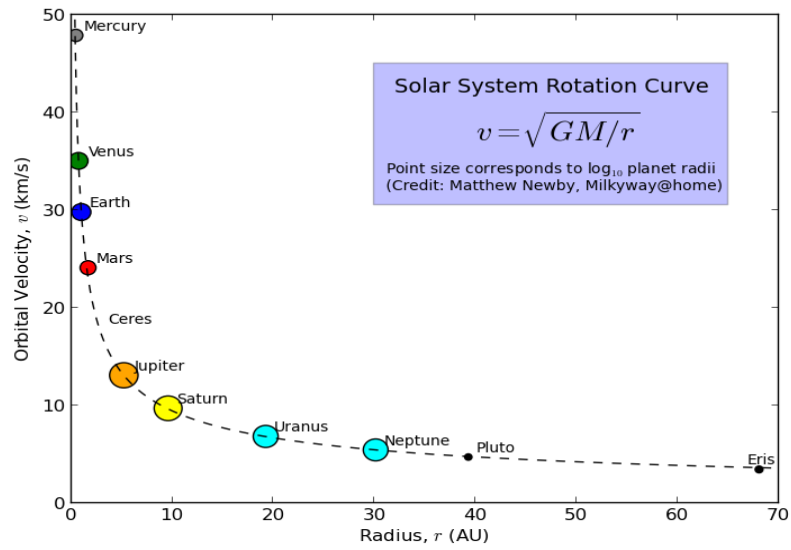


Figure 1.7: Rotation curves.