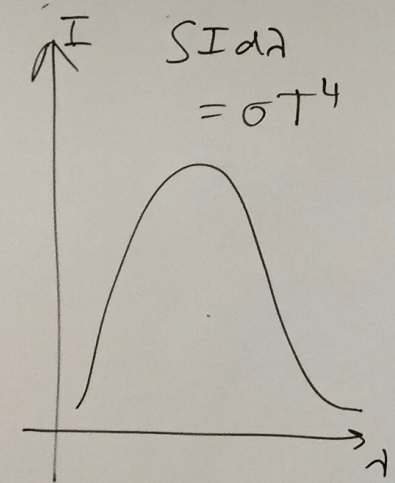


Planck's law



Penzias

Wilkinson:

3K

Universe: static X

cosmological principle { homogeneous
isotropic

$a(t)$ = average distance between galaxies

$$\dot{a} = \frac{da(t)}{dt} > 0$$

$$\frac{\dot{a}(t)}{a(t)} = ?$$

$$\text{If } a = 70 \text{ Mpc} = 2 \cdot 10^7 \cdot \pi \cdot 10^{16} \text{ m} = 6 \cdot 10^{23} \text{ m}$$

$$\dot{a} = 1.5 \cdot 10^6 \text{ m/s}$$

$$z = 0 \dots 0.08 \text{ (Image in slides)}$$

$$z \sim d \text{ (distance)}$$

$$z = \frac{\lambda_{\text{obs}}}{\lambda_{\text{emit}}} - 1$$

Special Relativity: $z+1 = \sqrt{\frac{1+v_{||}/c}{1-v_{||}/c}}$

$$v_{||} \equiv v_r \quad \left[\begin{array}{c} \nearrow \\ \leftarrow \\ \searrow \\ \downarrow \\ \nearrow \\ \leftarrow \\ \searrow \\ \downarrow \end{array} \right]$$

direction of observation

for $v_{||} \ll c \Rightarrow z \approx \frac{v_r}{c}$

$$\rightarrow \frac{\dot{a}}{a} = \frac{2.5 \cdot 10^{-18}}{\text{s}} = \frac{7 \cdot 10^{-11}}{\text{yr}} = H_0 \quad \frac{1}{H_0} = 14 \cdot 10^9 \text{ yr}$$