Answer on Question #45915, Physics, Astronomy — Astrophysics

If the temperature of the background radiation today is 3k , at what time after the birth of universe was the temperature (10)15 k? Take the age of the universe as 15 * (10)9 years.

Solution

We will take a simple cosmological model where scale factor a is related with time t as

$$a \sim t^{2/3}$$

Then, we know that $T \sim 1/a$ and temperature can be found as

$$\frac{T_0}{T_1} = \frac{t_1^{2/3}}{t_0^{2/3}}$$

And we find at what time it was 10^{15} K

$$t_1 = t_0 \left(\frac{T_0}{T_1}\right)^{3/2} = 15 \cdot 10^9 \left(\frac{3}{10^{15}}\right) \approx 2.5 \cdot 10^{-12}\, s$$