



New Frontiers in Cosmology.



Fernando Atrio-Barandela.

Física Teoría. Departamento de Física Fundamental.

Facultad de Ciencia. Universidad de Salamanca.

Plaza de la Merced s/n; 37008 Salamanca, Spain.

phn: ++34 923 294 437; fax: ++34 923 294 584

eml: atrio@usal.es

<http://web.usal.es/~atrio>



Indice.

1. Introduction.
2. Problems of the Big-Bang Model.
3. Cosmological vs Dark Energy.
4. Inflation
5. [Newtonian Cosmology].
6. The Harrison-Zeldovich Matter Power Spectrum.
7. Physics of the Baryon Photon Plasma.
8. CMB Temperature Anisotropies.
9. Secondary Anisotropies: Sunyaev–Zeldovich Effect.
10. Secondary Anisotropies: Integrated Sachs–Wolfe Effect.
11. Open Problems.



Bibliography.

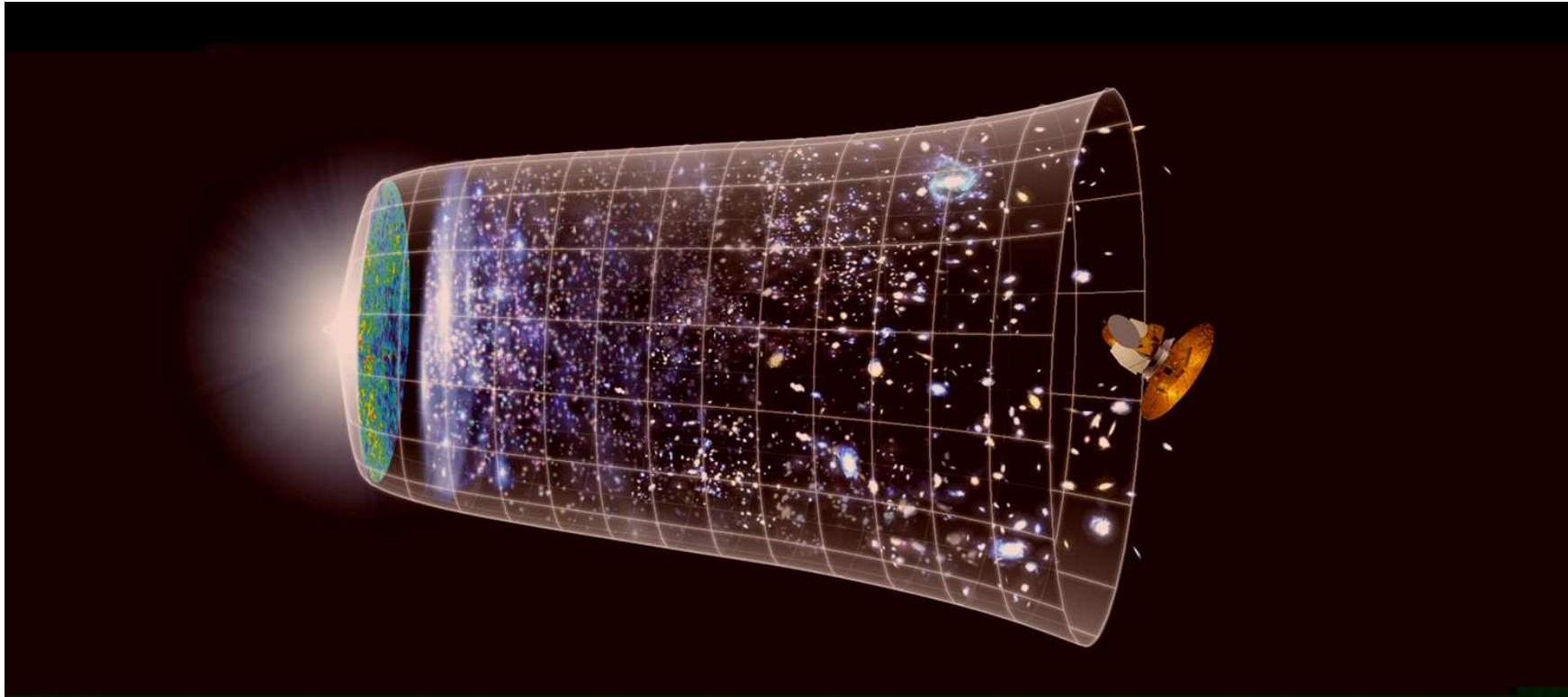
- ◇ "Cosmology". P. Coles, F. Lucchin. Wiley (2002).
- ◇ "Modern Cosmology". S. Dodelson. Academic Press (2003).
- ◇ "The Early Universe". E.W. Kolb, M.S. Turner. Addison–Wesley (1990).
- ◇ "Cosmological Inflation and Large-Scale Structure". A.R. Liddle, D.H. Lyth. Cambridge (2000).
- ◇ "Physical Foundations of Cosmology". V. Mukhanov. Cambridge (2005).
- ◇ "Structure Formation in the Universe". T. Padmanabhan. Cambridge (1993).
- ◇ "Cosmological Physics". J.A. Peacock. Cambridge (1998).
- ◇ "Large Scale Structure of the Universe". P.J.E. Peebles. Princeton (1980).

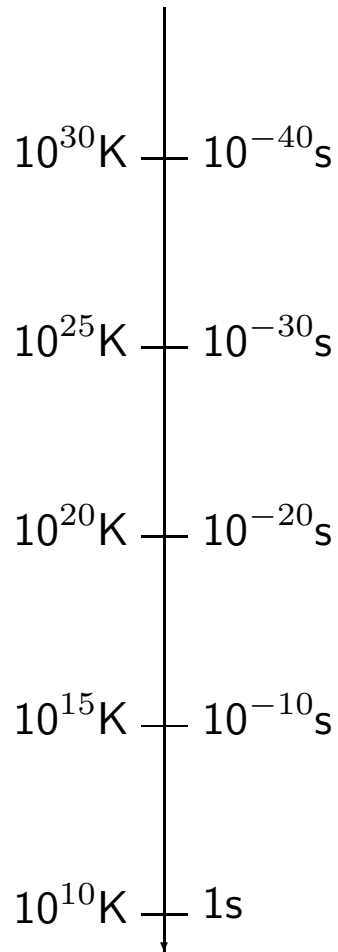


Introduction.



Timeline: from Light to the Dark Ages.





$$\leftarrow l_{pl} = (hG/c^3)^{1/2} = 4 \cdot 10^{-33} \text{ cm}$$
$$t_{pl} = l_{pl}/c = 1.3 \cdot 10^{-43} \text{ s}$$
$$m_{pl} = (hc/G)^{1/2} = 5.5 \cdot 10^{-5} \text{ g}$$

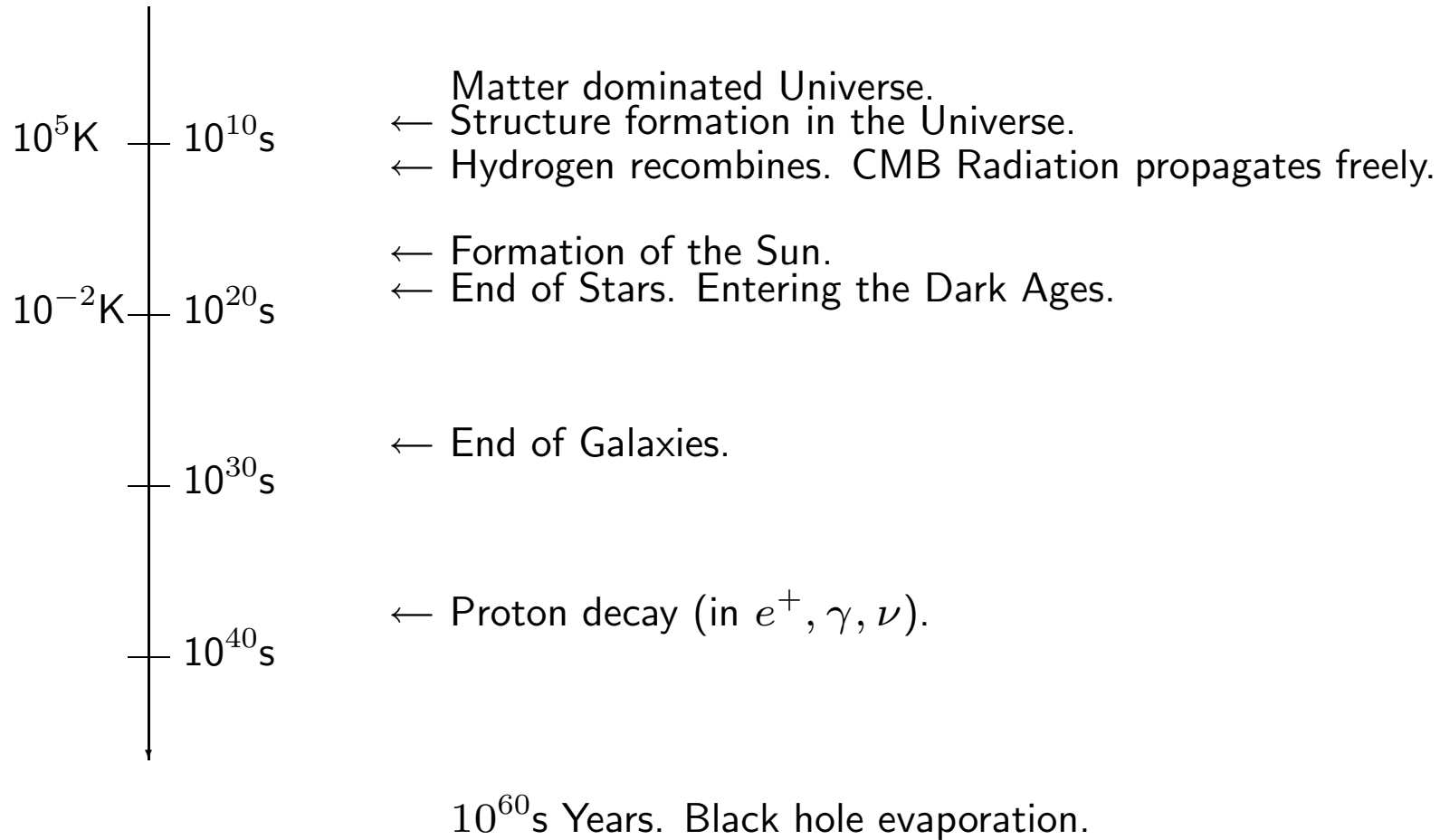
← Inflation.

← Symmetry-breaking: Gravity and strong-electroweak force.

← Symmetry-breaking: electro-weak and strong forces.

← Baryogenesis. Formation of protons and neutrons from quarks.

← e^+ , e^- - annihilation, Neutrino decoupling. Helium synthesis (25 - 30%).





Cosmological Parameters.

- ◇ Cosmological densities: $\Omega_\Lambda, \Omega_m = \Omega_b + \Omega_{cdm} + \Omega_\nu, \Omega_\gamma, \Omega_k$
- ◇ Equations of state: $w_\Lambda, \dot{w}_\Lambda$
- ◇ Age, expansion rate: t_o, H_o
- ◇ Degree of inhomogeneity: $A_S, n_S, A_T, n_T, \sigma_8$
- ◇ Opacity: τ