11 The Big Bang

- At the time of the Big Bang (a term coined by Hoyle) the Universe is supposed to be crushed into a point of infinite density. Needless to say we don't have a theory that is able to explain the physics of such conditions.

- It is expected that above a certain density, quantum effects become important for gravitation effects. This would happen when the Universe is at the Planck scale (or energy), obtained by combining $\hbar$, c, and G to obtain the appropriate units.

$$E_p \equiv \sqrt{\frac{\hbar c^5}{G}} \sim 10^{19}\ \text{GeV}$$

$$\ell_p \equiv \sqrt{\frac{G\hbar}{c^3}} \sim 10^{-35}\ \text{m}$$

$$t_p \equiv \sqrt{\frac{G\hbar}{c^5}} \sim 10^{-44}\ \text{s}$$

- this leads to a need for a theory of quantum gravity