

Horizons

- (a) Describe the concept of our past and future *light-cone*. Explain the meaning of the terms *particle horizon distance*, *event horizon distance* and *world-line* and discuss the difference between time-like and space-like locations.
- (b) Show that in an Einstein-de Sitter Universe in which the scale-factor $a(t)$ at time t follows $a(t) \propto t^{2/3}$, the particle horizon is at $3ct$ and the event horizon is at infinity.
- (c) Suppose that the scale-factor were given by $a(t) \propto \exp(mt)$ where m is a positive constant. Show that the event horizon is finite and that the particle horizon grows exponentially when $t \gg 1/m$.
- (d) Explain how such behaviour of the particle horizon might be useful in explaining observations of the cosmic microwave background.