The Acceleration of the Universe, a Challenge for String Theory

Willy Fischler (Univ. of Texas, Austin) (ITP 6-8-01)
\[ V \sim 1 / (1 + x) \]

Caustics limit: \( c_s \geq c - \alpha \beta x \beta^2 \)

\[ p = \kappa \rho \]

Eq. of State:

Solution with perfect fluid

\[ \frac{\dot{\rho}}{\rho} = -\frac{\dot{V}}{V} = \frac{\dot{p}}{p} \]

Exantion

Inertial

\[ \dot{E} = -\rho \dot{\rho} + T \dot{V} \]

Total

Plat. Homo. Equiv. Isotropic and

Cosm. seen. Unique Universe
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Energy density contrasts

$\rho_e \propto \frac{a^3}{1 - \frac{a^2}{\theta_0}}$

Fastest dilation of any fluid.

At $a = 0$, $\theta_0 = 1$.

Aside: Note $p = 0$.

$\rho_0 \sim \frac{(c_0 a e^2)}{1}$

$\rho_e \sim \frac{c_0 a e^2}{1} \rightarrow 0$
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\[ a = -\frac{4\pi}{3} \rho + \frac{3}{2} \dot{\rho} \]

\[ \dot{\rho} = -\nabla \rho \]

\[ \nabla \rho \rightarrow 0 \quad \text{as} \quad \rho \rightarrow 0 \]

Examples of acceleration:

\[ \rho \rightarrow \rho_c \quad \text{as} \quad r \rightarrow \infty \]

\[ \rho_c = \frac{m^2}{64\pi^2 M^2} \]

\[ \Omega_0 = \frac{m^2}{64\pi^2 M^2} \]

\[ \Omega = 1 \]
The right triangle picture to \( x > - \frac{1}{3} \). The picture to \( x < - \frac{1}{3} \) fails, which has an event line and a component horizon.

\[
\begin{align*}
0 < t &< - \frac{1}{ \sqrt{3} } \\
&\\
0 < x &< - \frac{1}{3} \\
&\\
0 < y &< - \frac{1}{3} \\
&\\
0 < z &< - \frac{1}{3}
\end{align*}
\]
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\[ V(\phi) \sim -\frac{\phi^2}{\Lambda^2} \]

For Flat Space Time

\[ V(\phi) \sim \frac{\phi^2}{\Lambda^2} \]

\[ \frac{\dot{\phi}}{\Lambda^2} \sim \frac{1}{\Lambda^2} \]

\[ \frac{\dot{\phi}^2}{\Lambda^2} \sim \frac{1}{\Lambda^2} \left( \frac{\dot{\phi}}{\Lambda^2} + \frac{1}{\Lambda^2} \right) \]

\[ \frac{\dot{\phi}^2}{\Lambda^2} \sim \frac{1}{\Lambda^2} \left( \frac{\dot{\phi}}{\Lambda^2} + \frac{1}{\Lambda^2} \right) \]

\[ \text{for Static Observer in Static Universe} \]
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# of States

A pert. solution = infinite

EX. Assuming if there was a sheet

no continuous world

not a fixed point

$$\frac{\Delta x}{\Delta y} \sim \frac{\Delta x}{\Delta y}$$

 Niet

Perturbative String Theory

What about the Stere
Such a formulation is not capable of describing the universe in the acceleration or its future observations. Conclusion:

What are the possibilities for a flux or acceleration of the flat space? Are there configurations?