Astro 340
Origin of the Universe
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Homework #10 Solutions

Problem # 1 (11.3)

t_o/t_H=15/17=.88>2/3
From table 11.1 the hyperbolic k=-1 model will be the acceptable standard model.

The addition of a negative(attractive) Λ results always in recollapse (see fig. 11.6). A positive Λ will not affect the hyperbolic model, except in making them expand exponentially.

Problem # 2 (11.4)

$z=(R_{now}/R_{then})-1=4$. The Universe was 1/5 compared to now.

The lookback time is 7.37 billion years

The factor $2/3H_o$ will be replaced a factor smaller than that in spherical model (see table 11.1) resulting in smaller lookback time

Problem # 3 (11.5)

$\Omega=1+kc^2/H^2R^2$. It varies inversely proportionally to H^2.

For the case where $\Omega=1$, the density parameter is equal to 1 at all times, k=0 and the Universe is flat. Ω is independent of the value of the Hubble constant.

Problem 4 (11.3)

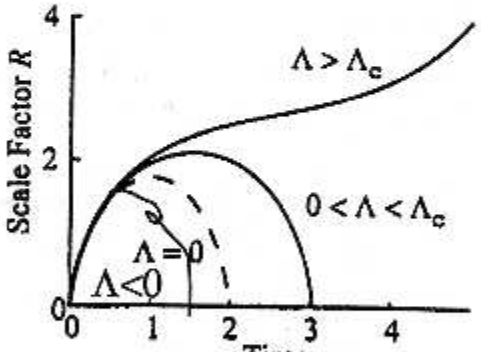

Fig. 11.10 The Lemaître model has spherical geometry and a Λ value slightly greater than the Einstein critical value Λ_c. This model features a hovering period, during which the scale factor remains nearly constant over a lengthy time interval. Following the hovering period, expansion continues at an accelerating rate with $q < 0$.