Physics 786, Spring 2023
Problem Set 11 Due Friday, May 5.

Your final paper is due the same day as this (short) assignment. However, extensions on both the paper and this assignment will be granted automatically until the final exam slot on Fiday, May 16, 2pm.

Final 10-12 minute presentations (15 minutes total including questions) will take place in class this Wednesday and Friday, and during the final exam slot.

1. *FRW Universe with Cosmological Constant*

If Einstein's equations are modified to include a cosmological constant:

$$R_{\mu\nu} - \tfrac{1}{2}g_{\mu\nu}R - \Lambda\,g_{\mu\nu} = -8\pi G_N T_{\mu\nu},$$

then the scale factor of the FRW universe satisfies

$$\dot{R}^2 + k = \frac{8\pi G_N}{3}\rho R^2 + \frac{\Lambda}{3}R^2.$$

Show that if Λ is large enough a $k = 1$ universe can expand forever.