

Astro 321: Problem Set 2  
Due April 14

## 1 Problem 1: Acceleration from Modified Gravity

- Explore the possibility that the acceleration of the expansion is due to a modification of gravity instead of dark energy. Consider that the Hubble parameter  $H(z)$  has dimensions of inverse length and suppose that there is some fundamental length scale at which gravity is modified  $r_c$ .

By dimensional analysis, explore the possible changes to the left hand side of the Friedman equation that involve  $H$  and  $r_c$  (hint: astrophysicists love power laws). If the right hand side involves non-relativistic matter only  $\rho_m$  in a flat geometry, argue that there is a class of possibilities where the scale factor eventually scales exponentially with time as in the  $\Lambda$ CDM model.

The “DGP” braneworld cosmology exhibits this sort of behavior.