

Special Topics in Cosmology (Spring 2013)

Problem Set 3

1) Using the modified Einstein equation for $f(R)$ gravity:

$$F(R)R_{\mu\nu} - \frac{1}{2}f(R)g_{\mu\nu} - \nabla_\mu \nabla_\nu F(R) + g_{\mu\nu} \square F(R) = 8\pi G T_{\mu\nu},$$

where $F(R) \equiv \partial f(R)/\partial R$, find the modified Friedman equations.

Due to: 10 March 2013

2) Using the Modified Friedman Equations for

$$f(R) = R - \frac{\mu^4}{R},$$

Plot the $E_{MG} - E_{\Lambda CDM}$ versus redshift, where $E \equiv H(z)/H_0$

Due to: 10 March 2013

3) Show that in the action level, $f(R)$ modified gravity is equivalent to the dark energy model, where $F(R)$ is playing the role of scalar field in quintessence.

Due to: 10 March 2013

4) Discuss the difference of Jordan and Einstein frames in gravity action.

Due to: 10 March 2013

5) Find the modified Einstein equations for DGP- models.

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