

Astro 321

Set 1: FRW Cosmology

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FRW Cosmology

- The Friedmann-Robertson-Walker (FRW sometimes Lemaitre, FLRW) cosmology has two elements
 - The FRW geometry or metric
 - The FRW dynamics or Einstein/Friedmann equation(s)
- Same as the two pieces of General Relativity (GR)
 - A metric theory: geometry tells matter how to move
 - Field equations: matter tells geometry how to curve
- Useful to separate out these two pieces both conceptually and for understanding alternate cosmologies, e.g.
 - Modifying gravity while remaining a metric theory
 - Breaking the homogeneity or isotropy assumption under GR

FRW Geometry

- FRW geometry = homogeneous and isotropic on large scales
- Universe observed to be nearly isotropic (e.g. CMB, radio point sources, galaxy surveys)
- Copernican principle: we're not special, must be isotropic to all observers (all locations)

Implies homogeneity

Verified through galaxy redshift surveys

- FRW cosmology (homogeneity, isotropy & field equations) generically implies the expansion of the universe, except for special unstable cases