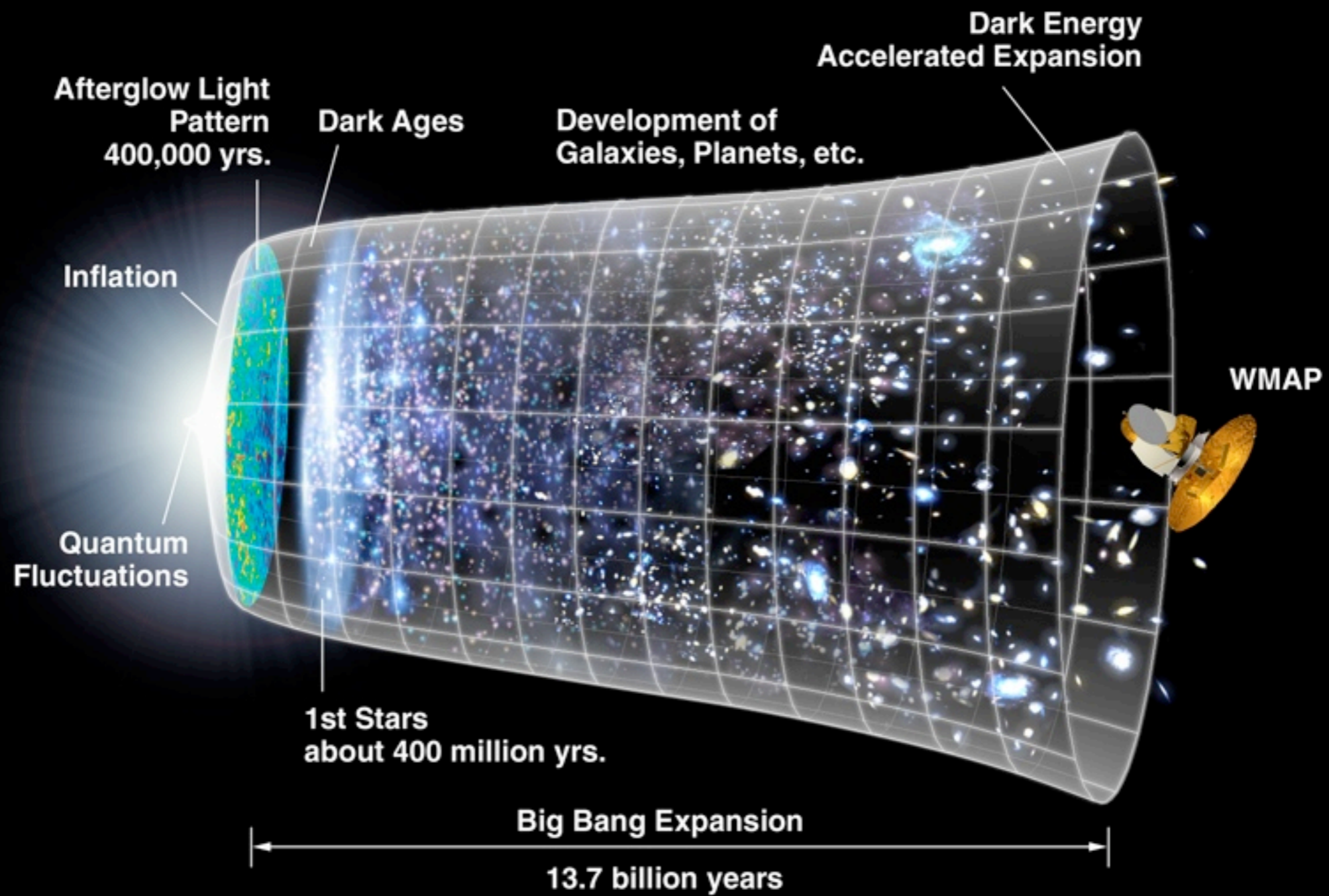


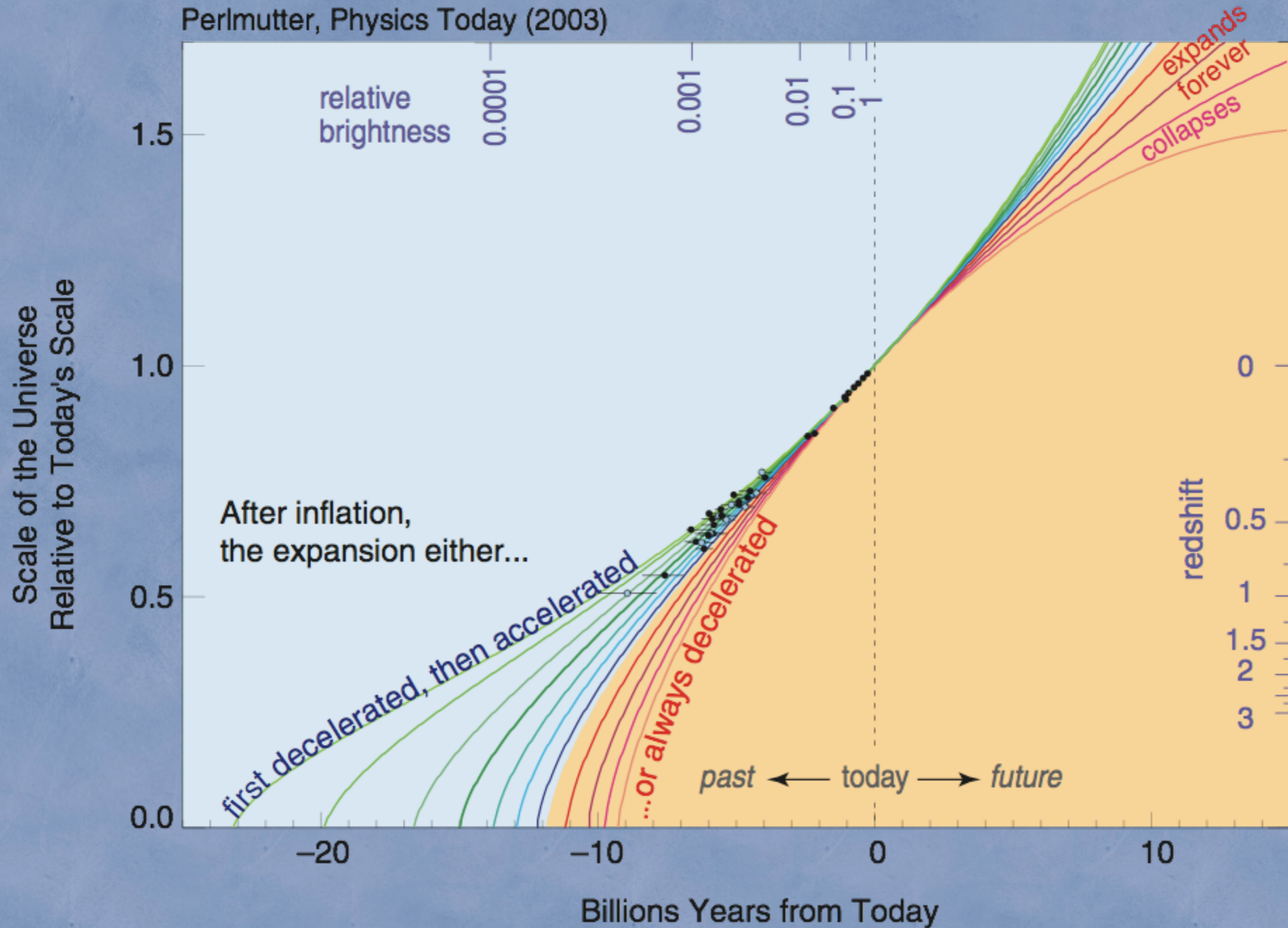
# Observational Evidence for Dark Energy: Summary and Assorted Thoughts

Michael Wood-Vasey  
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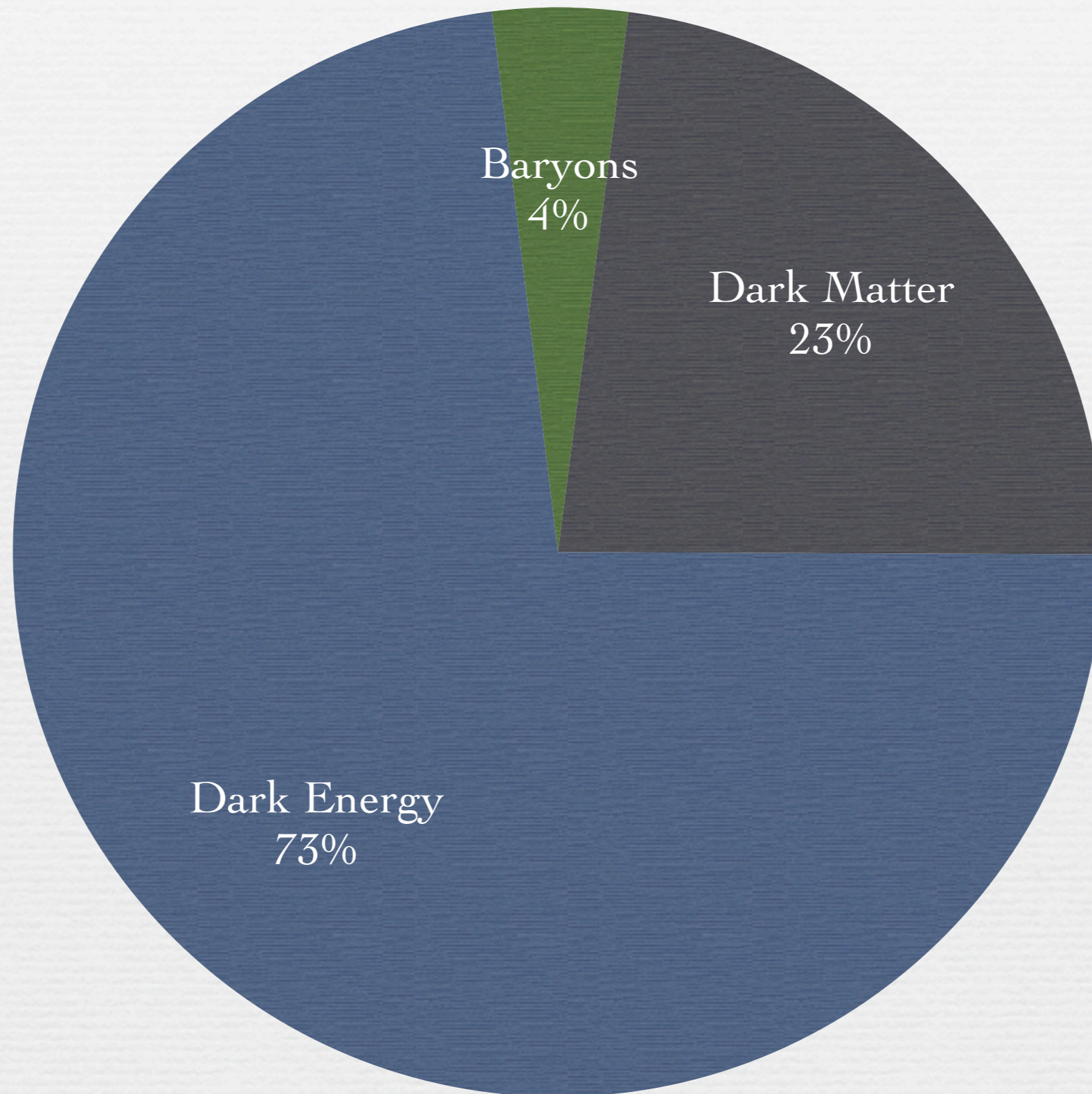


# Expansion History of the Universe

Perlmutter, Physics Today (2003)

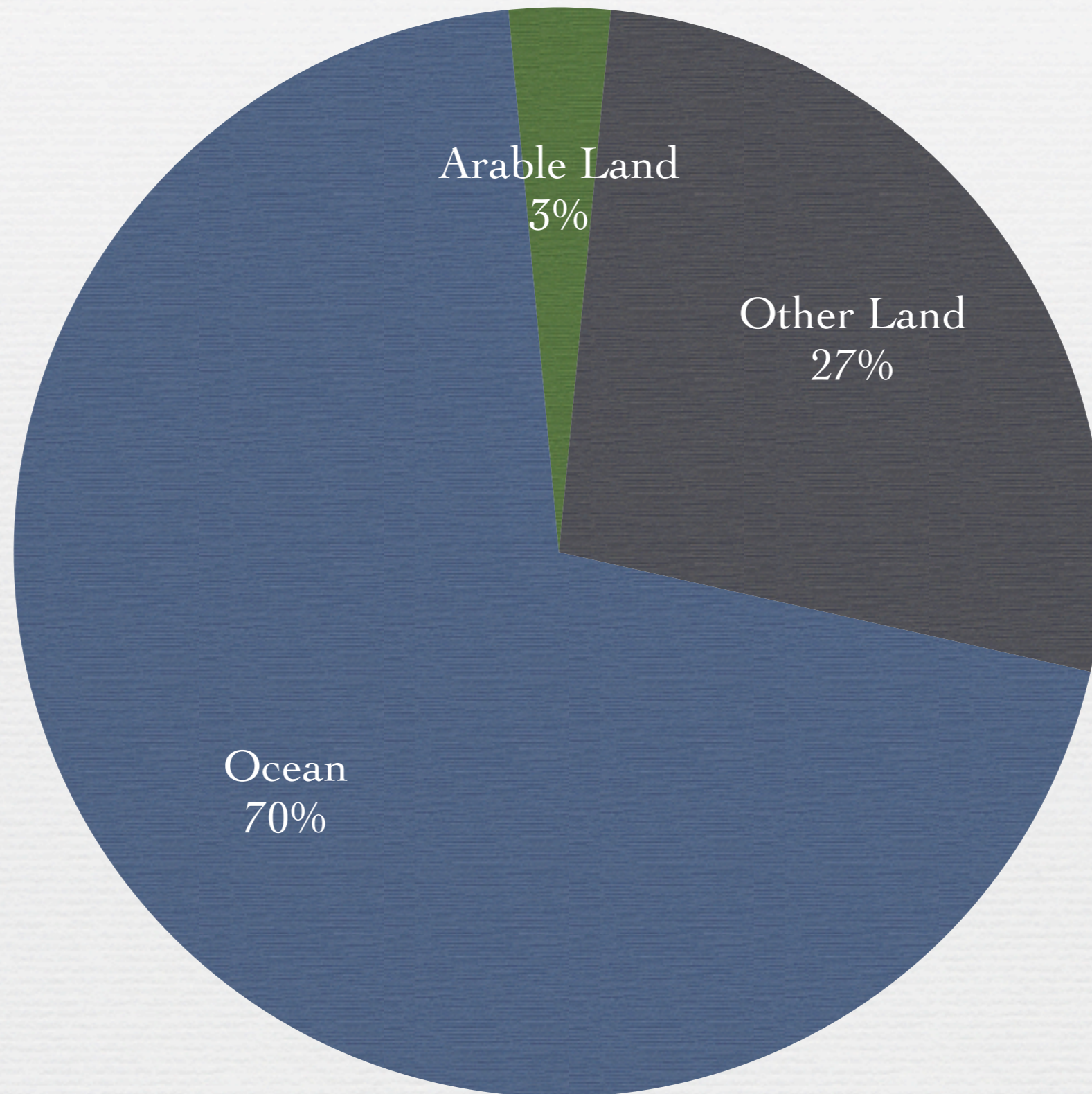


# Composition of Universe



c.f. Astier06, Spergel06, Eisenstein05, Perlmutter99, Riess98

# Composition of Earth's Surface



# What Is Dark Energy?

- Repulsive component
- Negative pressure
- Everywhere
- No observed structure
- Particle Physics?
- Cosmological Constant?
- Modification of GR?

# The Basic Question:

Is a cosmological constant model  
consistent with our observations of  
the Universe?

# The Basic Question:

Is  $w = -1$ ?

# How should we measure $w$ ?

• Dynamic Methods to constrain theorists

• Baryon Acoustic Oscillations

• Galaxy Clusters

• SNIa Luminosity Distances

• Weak Lensing

• Basic Framework to test theorists

• CMB: curvature, GW -- test inflation

# Dark Matter

- Have several decent theories
- Could find in next 10 years
- New particle
  - LHC
  - recoil experiments
- Astrophysics
  - Self-annihilation signal (e.g., GLAST)
  - baryon filling of DM structure
    - observations from sensitive large surveys
    - improved simulations

# Dark Energy

- Have no decent theories
- Currently appears pervasive
- Maybe has structure?
- Variable with cosmic time
- Observations throughout cosmic time
  - Prioritization tricky w/o better theory
- \$100 million - \$1 billion to make progress

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Potential donors please contact  
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All I want is a  
well-motivated theory!

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well-motivated theory!

Is that too much to ask?

Is this really the  
path towards  
understanding  
Dark Energy?

Courtesy of David Weinberg

