

4.

Paradoxes that Planck will attempt to resolve:

The Universe is close to spatially flat, is dominated by dark energy and dark matter, is currently accelerating in its expansion rate, and present-day structure grew from nearly scale invariant primordial fluctuations.

These are some of the as-yet-unresolved mysteries which we hope Planck data will help resolve!

Unsolved mysteries that we hope Planck will shed light on:

What is the nature of the dark energy?

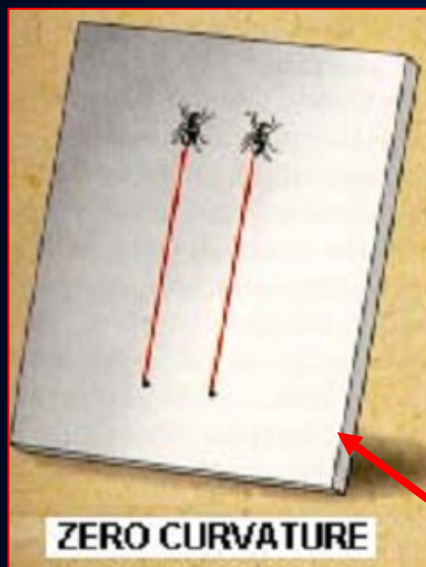
Why is the density of dark energy, or “lambda,” apparently so much less by cosmological observations, than is predicted by quantum mechanical considerations – by about 120 orders of magnitude?

What is the dark matter made of?

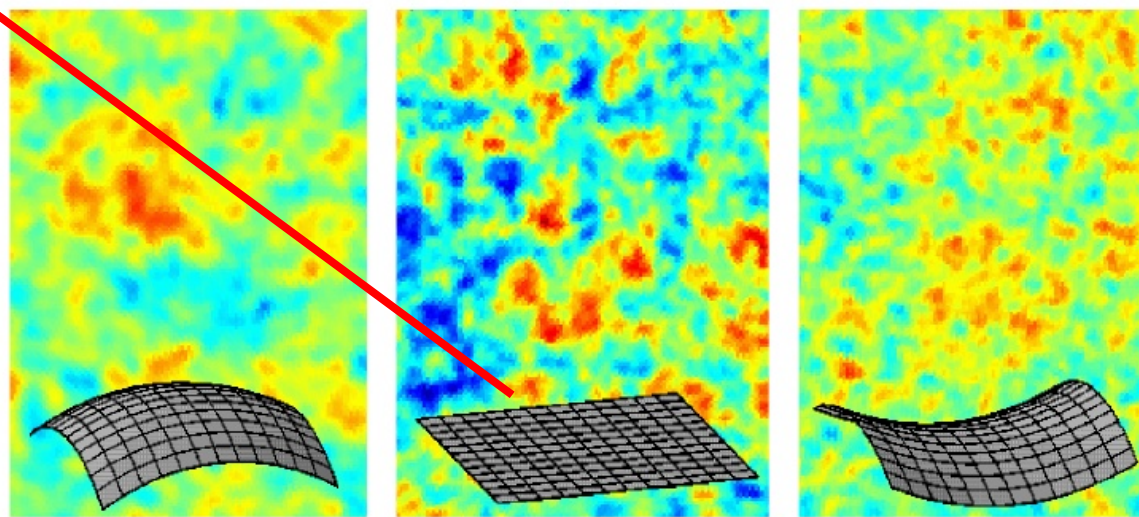
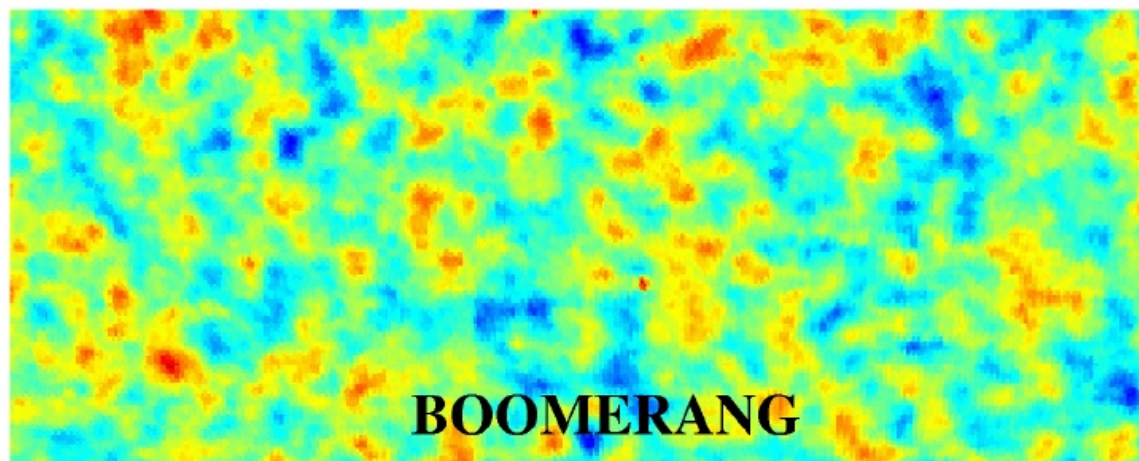
Are there effects of “physics beyond the Standard Model” that can be found in the CMB power spectrum?

What can we learn about the future expansion of the Universe?

Variations in the temperature of space today have precisely the size we would expect if the shape of the Universe is FLAT. But what does this physically mean?



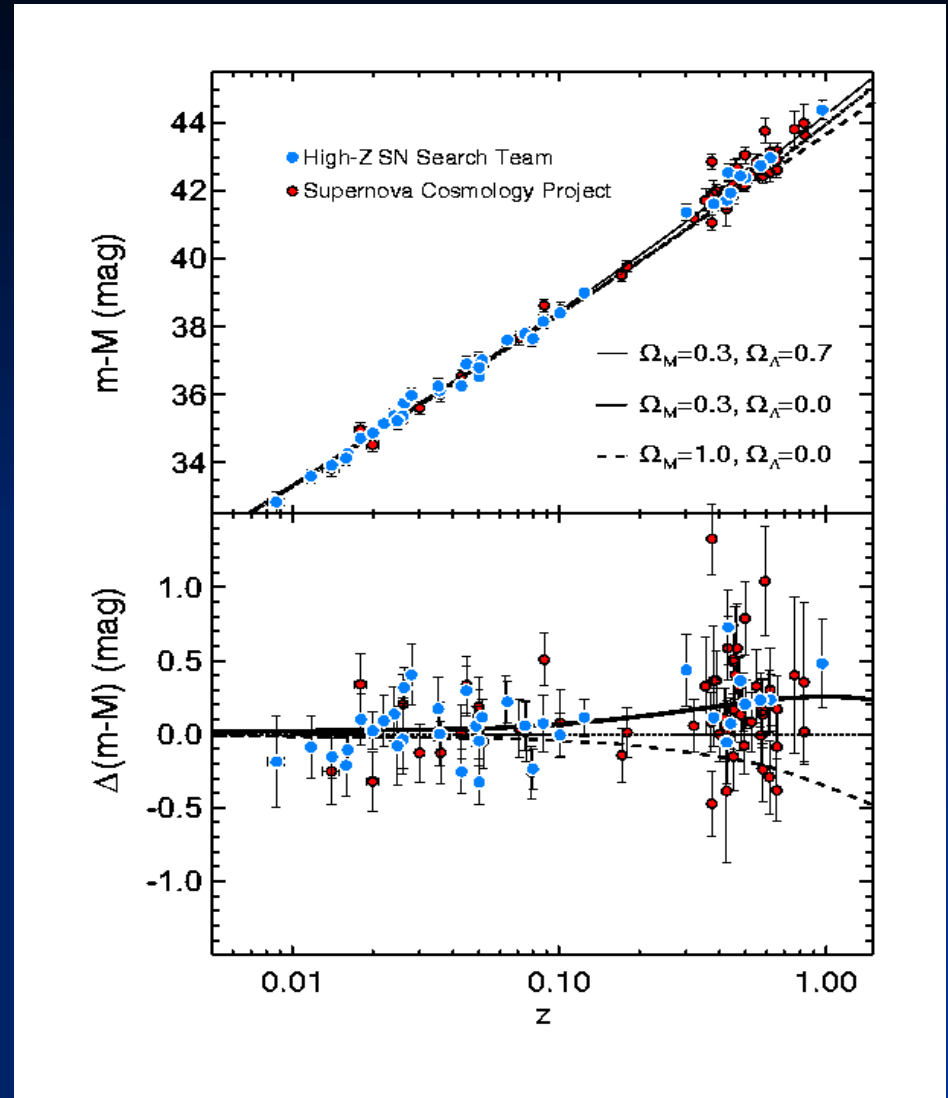
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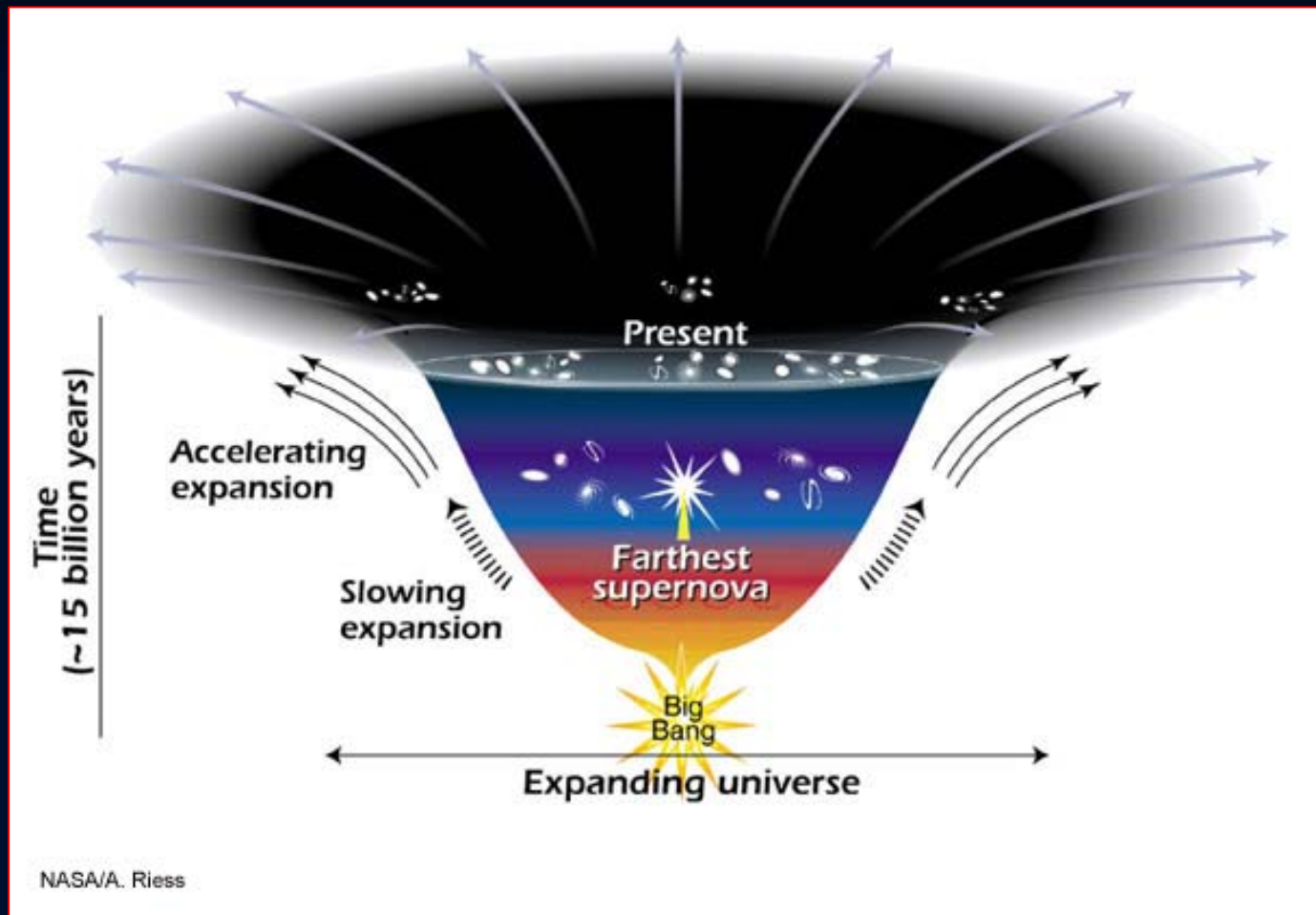
From Type Ia Supernovae, we have determined that the expansion rate of the Universe began accelerating about 5 billion years ago.

This observation “brought back” Einstein’s idea of a cosmological constant which causes a gravitational “repulsion,” except we don’t understand how such dark energy, as it is called, can be produced.

The nature of this dark energy may be better understood from a more accurate determination of the CMB power spectrum.



For more information on the high red shift SNe data, please see our Labs for a Lambda-Dominated Universe available on www.deepspace.ucsb.edu.



It is uncomfortable to think that the expansion of the Universe is accelerating! This leads to the conclusion that in 10 billion years or so, an observer in our Milky Way Galaxy would not be able to observe other galaxies or even the CMB!

$$\rho = \rho_{baryon} + \rho_{darkmatter} + \rho_{radiation} + \rho_{\Lambda}$$

It is also an uneasy feeling that the majority of ‘stuff’ in our Universe is composed of matter and energy that we can’t see, and have no idea what it is!

This is the ultimate Copernican Principle! Not only are we not the center of the Universe, we are a mere 4% of the total matter/energy in the Universe!

