Shaul's List

What would be the impact of a positive B-mode detection?

What would be the impact of no B-mode detection at a level of r=0.01?

What are the arguments that r is larger than 0.01?

What would be the value of a mission that measured lensing B modes very well, but did not detect primordial B modes?

What priority would you give a $1B investment in a CMB polarization mission compared to other possible astrophysics space missions?

If you think it is worthwhile, how would you articulate this to colleagues?

What are the arguments that r > 0.01 ?

Inflation

generically produces a nearly scale-invariant spectrum of gravitational waves with amplitude roughly comparable to the density fluctuation amplitude

Alternatives

the only known alternatives for producing adiabatic, nearly scale-invariant perturbations – using the ekpyrotic mechanism – do not

What are the arguments that r > 0.01 ?

Inflation

fluctuations are due to a gravitational effect of the background that is indiscriminant: all light degrees of freedom are subject to the same fluctuations.

Alternatives

primordial fluctuations are due to a non-gravitational effect that only affects fields with steep, negative potentials (therefore, not g-waves)

What are the arguments that r > 0.01 ?

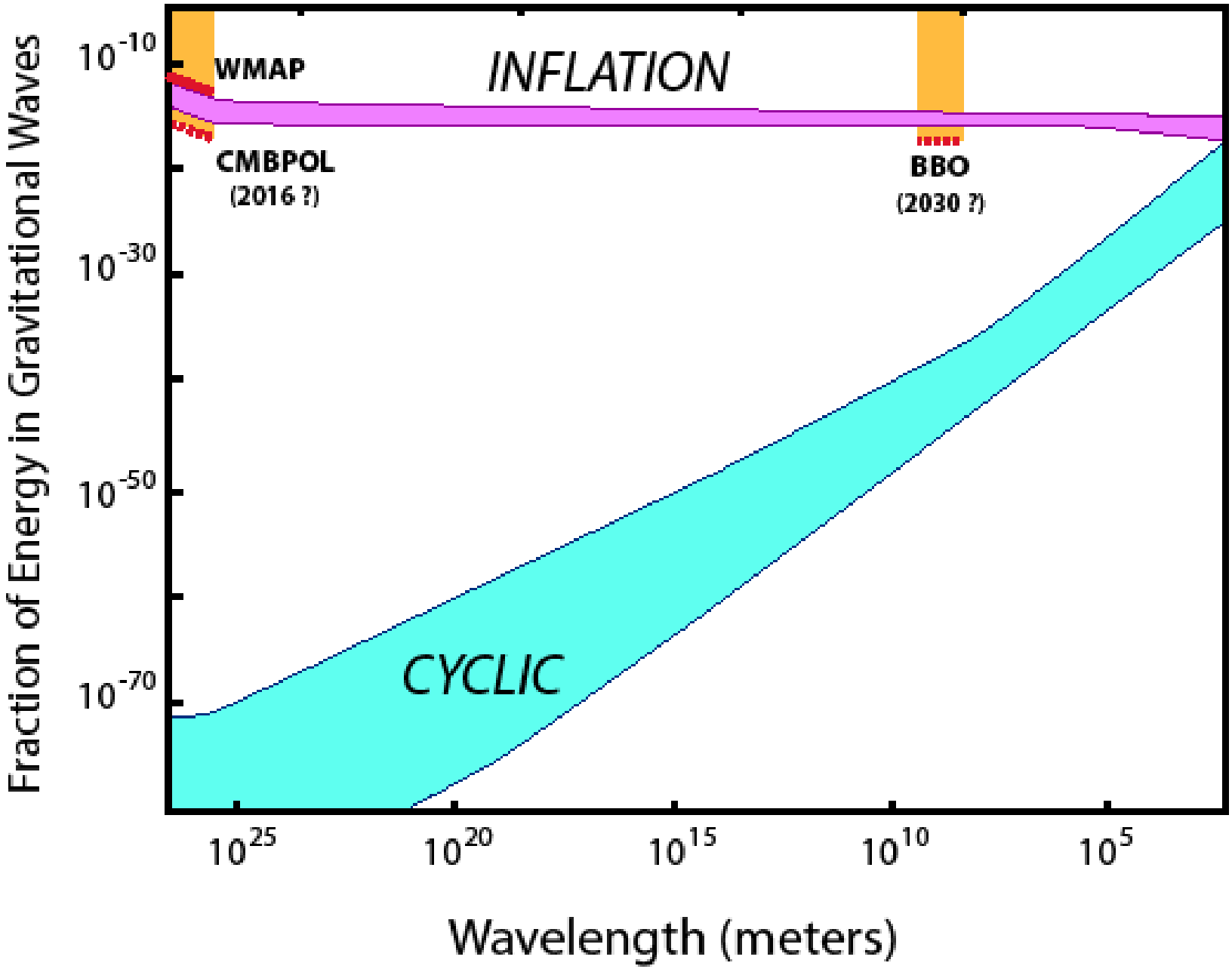
Inflation

r ~ 0.01 – 0.4*

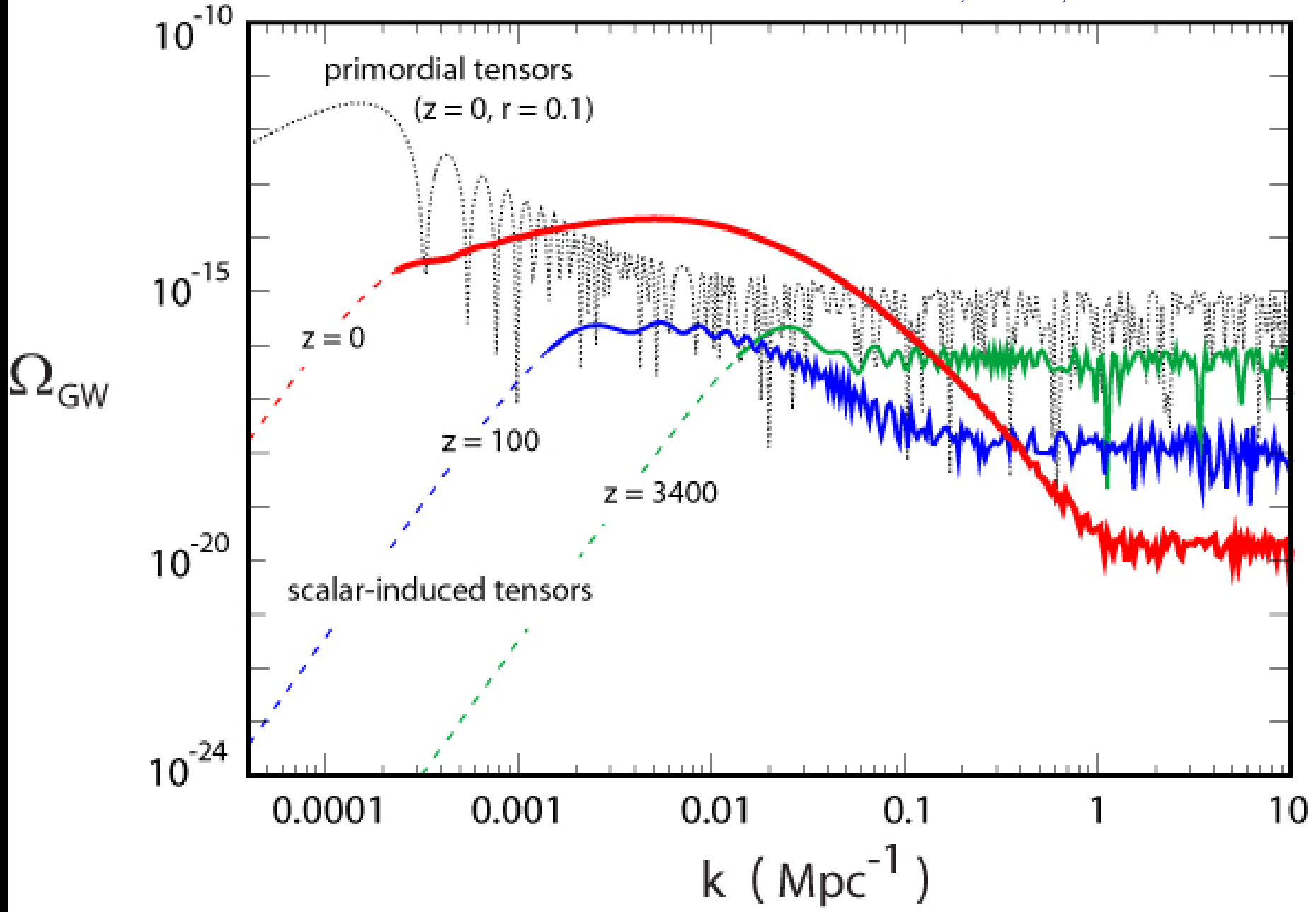
Alternatives

primordial r exponentially suppressed

primordial g-waves



from Baumann, PJS, Takahashi, Ichiki
see also Mollerach, Harari, Mattarese
Ananda, Clarkson, Wands



What are the arguments that r > 0.01 ?

Inflation

r ~ 0.01 – 0.4*

*qualifications

$r \sim (1+w)^{1/4}$

Alternatives

primordial r exponentially suppressed

What would be the impact of a positive B-mode detection?

- opens the window to measuring the g-wave spectrum (e.g., tilt)
- verifies the natural prediction of inflation
- determines energy scale for physics beyond the standard model that created large scale structure of the universe
- supports notion that fluctuations and seeds for galaxy formation were created by events occurring after the big bang
- lends support to the big bang being the effective beginning of spacetime
- definitively eliminates the competing ekpyrotic/cyclic alternatives
- definitively eliminates (almost) all current string inflation models

What would be the impact of no B-mode detection at a level r > 0.01?

- first (?) serious blow to simplest inflation models
- restricts future consideration of inflation to models with extra degrees of freedom and finely-tuned parameters
- verifies the natural prediction of ekpyrotic/cyclic models
- proves that the fluctuations were created during a period of small H:
  slow contraction (ekpyrotic)
  slow expansion (finely-tuned inflation)
- sets upper bound for energy scale for new physics that created the large scale structure of the universe
- lends support to idea of fluctuations created before the bang, hence encourages research on big bang physics and novel solutions to other cosmological problems

What would be the impact of no B-mode detection at a level r > 0.01, but measurement of lensing B-modes?

- add confidence in the absence of primordial B-modes
- improve measurement of lensing, large scale structure, cosmological parameters
- test for cosmic strings
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