

- This session is devoted to future CMB polarization satellites.
  - EPIC
  - PIXIE
  - LiteBIRD
  - COrE
  - PRISM (a new L-class mission)

# Three Elements of satellite project

## ● Mission

~ scientific objectives, full success criteria

## ● System

~ mission components, bus system, launch vehicle, etc.

## ● Project

~management, cost, schedule, etc.

# Example questions about “Mission”

- Focusing on tensor-to-scalar ratio, or broader topics ?
- $\delta r < 0.001$  required ?
- $\delta r < 0.001$  sufficient ?
- Scientific justification for non-detection case ?
  - see the next page

# Particle physics example: LHC

- No lose theorem of LHC
  - Either discover Higgs or rule out the Standard Model of particle physics
    - multi billion \$ awarded
- There were many other models that could explain all the experimental results.
- “Standard” model was a social construct, based on “Occam’s razor” principle
  - so far simplest models have always won in fundamental physics.

# LiteBIRD mission as example

- Check simple well-motivated inflationary models
  - *requirement on the uncertainty on  $r$*   
(stat.  $\oplus$  syst.  $\oplus$  foreground  $\oplus$  lensing)  **$\delta r < 0.001$**

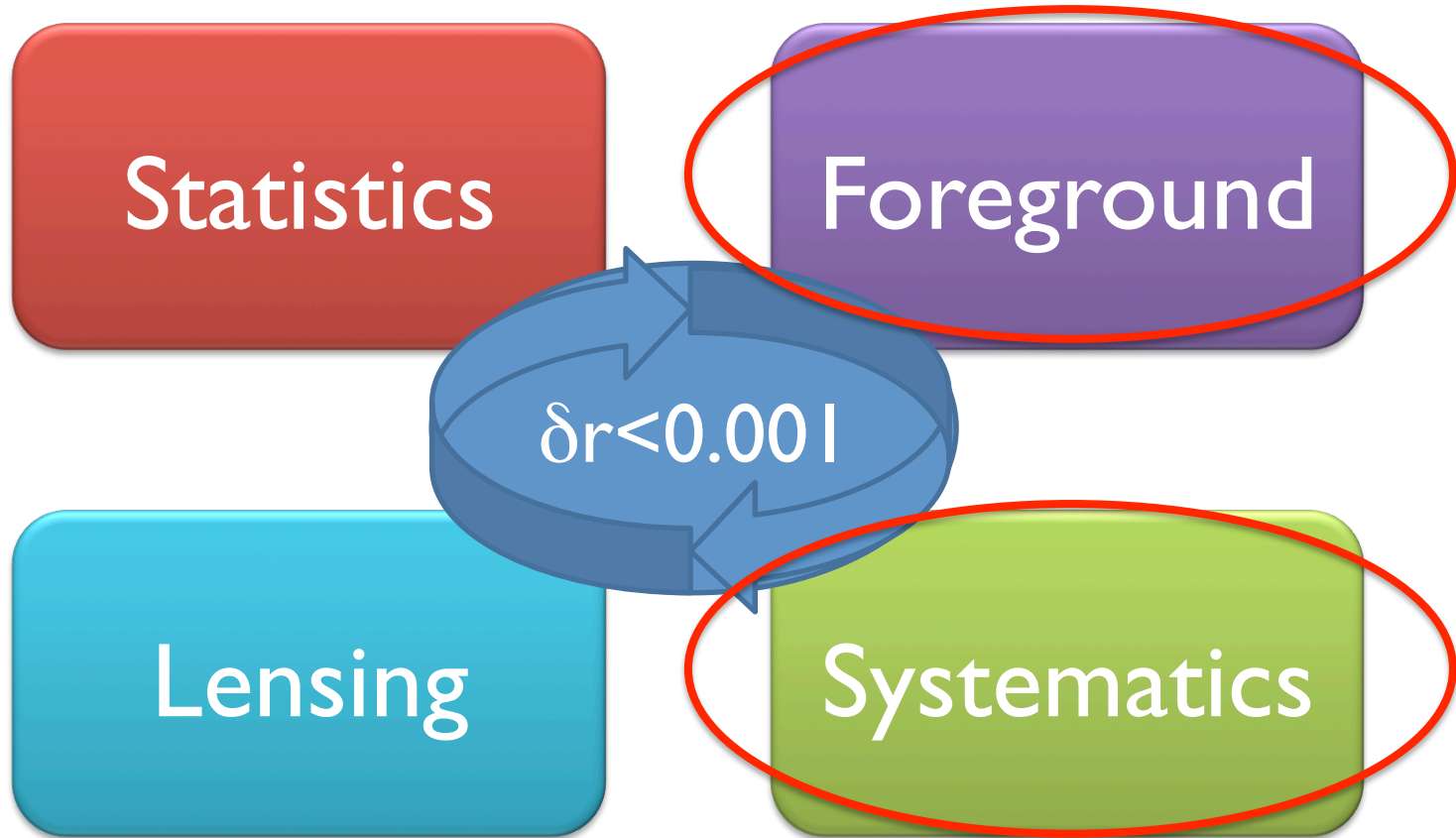
No lose theorem of LiteBIRD

- Many inflationary models predict  $r > 0.01 \rightarrow > 10\sigma$  discovery
- Simple well-motivated inflationary models (single-large-field slow-roll models) have a lower bound on  $r$ ,  $r > 0.002$ , from Lyth relation.  
$$r = \frac{1}{N^2} \left( \frac{\Delta\phi}{m_{\text{pl}}} \right)^2 \approx 2 \cdot 10^{-3} \left( \frac{\Delta\phi}{m_{\text{pl}}} \right)^2$$

H. Kodama,  
K. Kohri, MH
- no gravitational wave detection at LiteBIRD  $\rightarrow$  exclude all these simple well-motivate inflationary models (i.e.  $r < 0.002$  @ 95% C.L.)
- Early indication from non-space-based projects  $\rightarrow$  power spectra at LiteBIRD !

Similar to LHC Higgs case (Occam's razor)

# System issues



# Example questions on “System”

- LEO or L2 (or else) ?
  - LEO: Effects of the Moon (thermal, sidelobe)
  - L2: Cosmic rays
- How many bands do we need in 50-300GHz for foreground separation ?
- Beyond the standard systematics ?
  - combined effect of systematics and foregrounds

- Achieving  $\delta r < 0.001$  is a huge experimental challenge, which looks as crazy as Higgs hunting in proton-proton collisions where signal-to-noise is 1:  $\sim 1000000000000000$ .
- We need to exchange ideas and have constructive discussions.