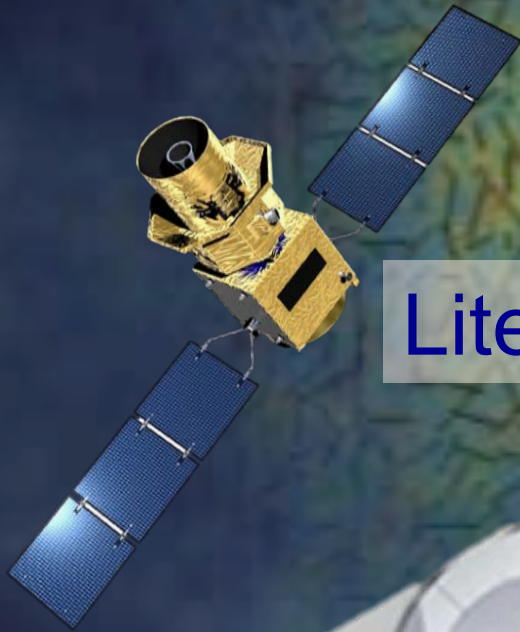


B01: Large-area CMB surveys for studies of cosmic acceleration and large-scale structure



LiteBIRD

Simons Array

artistic impression

Masashi Hazumi (KEK / Kavli IPMU / SOKENDAI)

B01 Co-Is (研究分担者)



Nobu Katayama



Kazuhisa Mitsuda



Yutaro Sekimoto



Hirokazu Ishino



Masaya Hasegawa

B01 Collaborators (連携研究者)



Tomo Matsumura



Osamu Tajima



Tsuneo Kii



Yuji Chinone



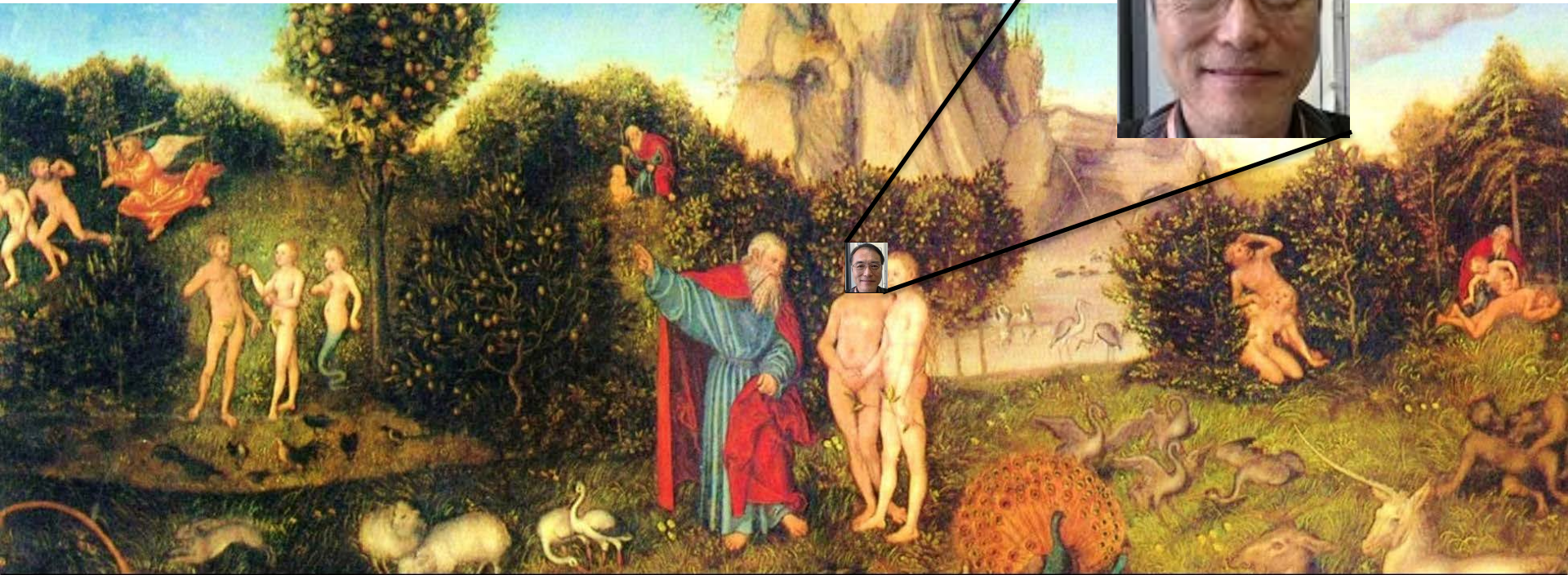
Haruki Nishino

+ Other researchers
Postdocs,
and Students



Masashi Hazumi (PI)

Our Role



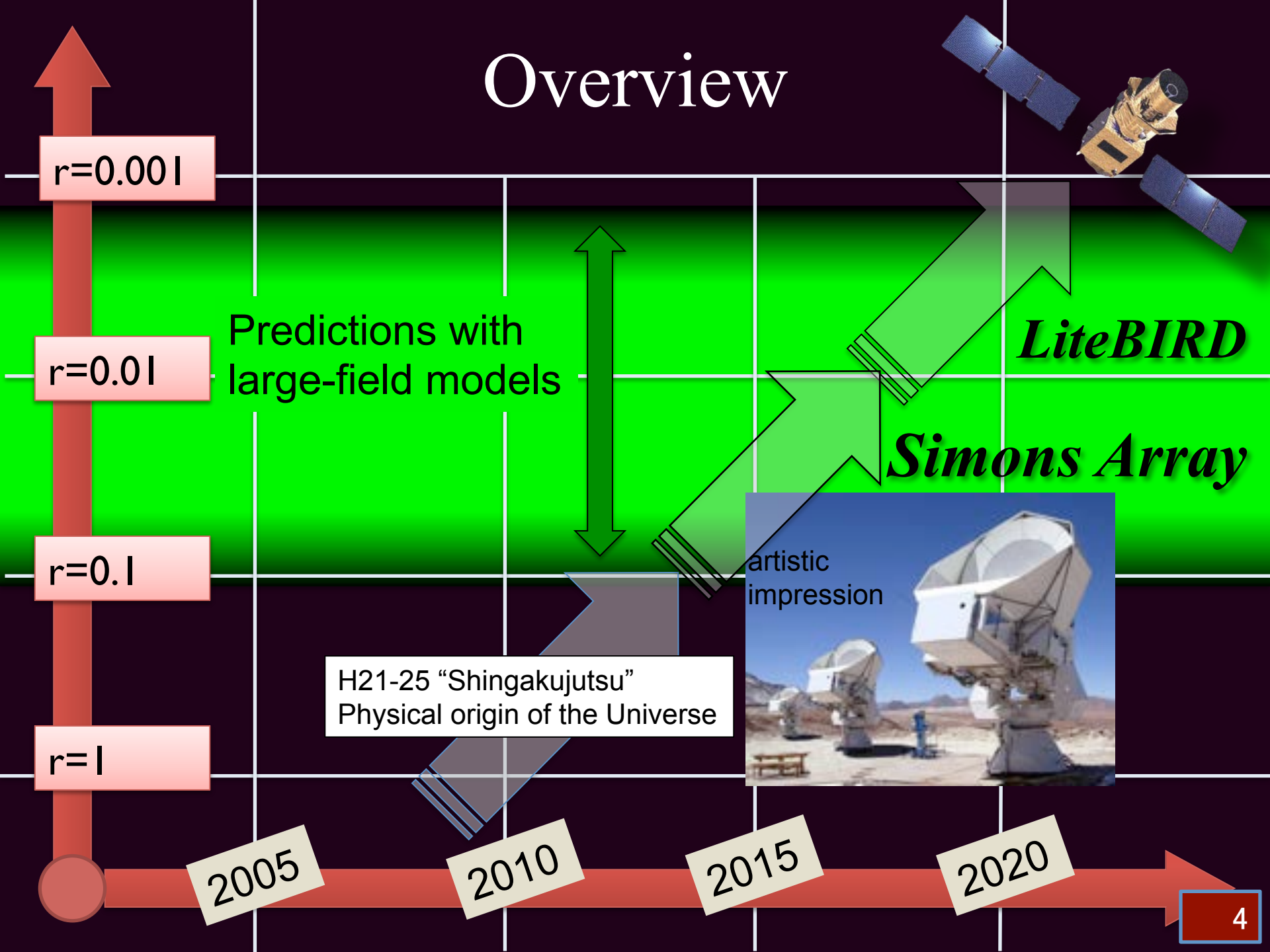
PARADISE LOST

by John Milton

GreatestAudioBooks.com

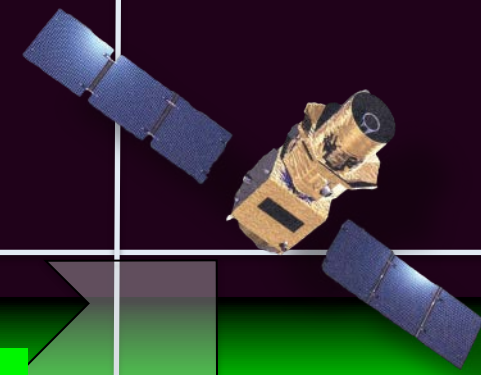
This slide is dedicated to Sasaki-san.

Overview



Overview

$r=0.001$



LiteBIRD

Uncover the whole picture of CMB polarization

- LiteBIRD: large angular scales
- Simons Array: medium/small angular scales

Simons Array

$r=0.1$

artistic
impression



H21-25 "Shingakujutsu"
Physical origin of the Universe

$r=1$

2005

2010

2015

2020

B01 Scope

- Simons Array
 - Multi-chroic observations with three telescopes
 - High frequency ($>200\text{GHz}$) included for foreground separation
 - Goals
 - $\sigma(r) < 0.01$
 - $\sigma(\Sigma m_\nu) < 100\text{meV}$
 - n_s will also be improved from E-mode measurements.
 - Bonus: Also serve as a general-purpose cosmology/astronomy telescope
- LiteBIRD
 - Design, development and tests of key instrumental components for launch in 2020s
 - Simulation studies (foreground, systematics) to determine observation strategy
 - Goal
 - Establish the technology/system to achieve $\sigma(r) < 0.001$

Note: POLARBEAR-2 and GroundBIRD are pushed forward with KAKENHI Kiban(S) and thus are out of the scope of B01 in terms of funding.

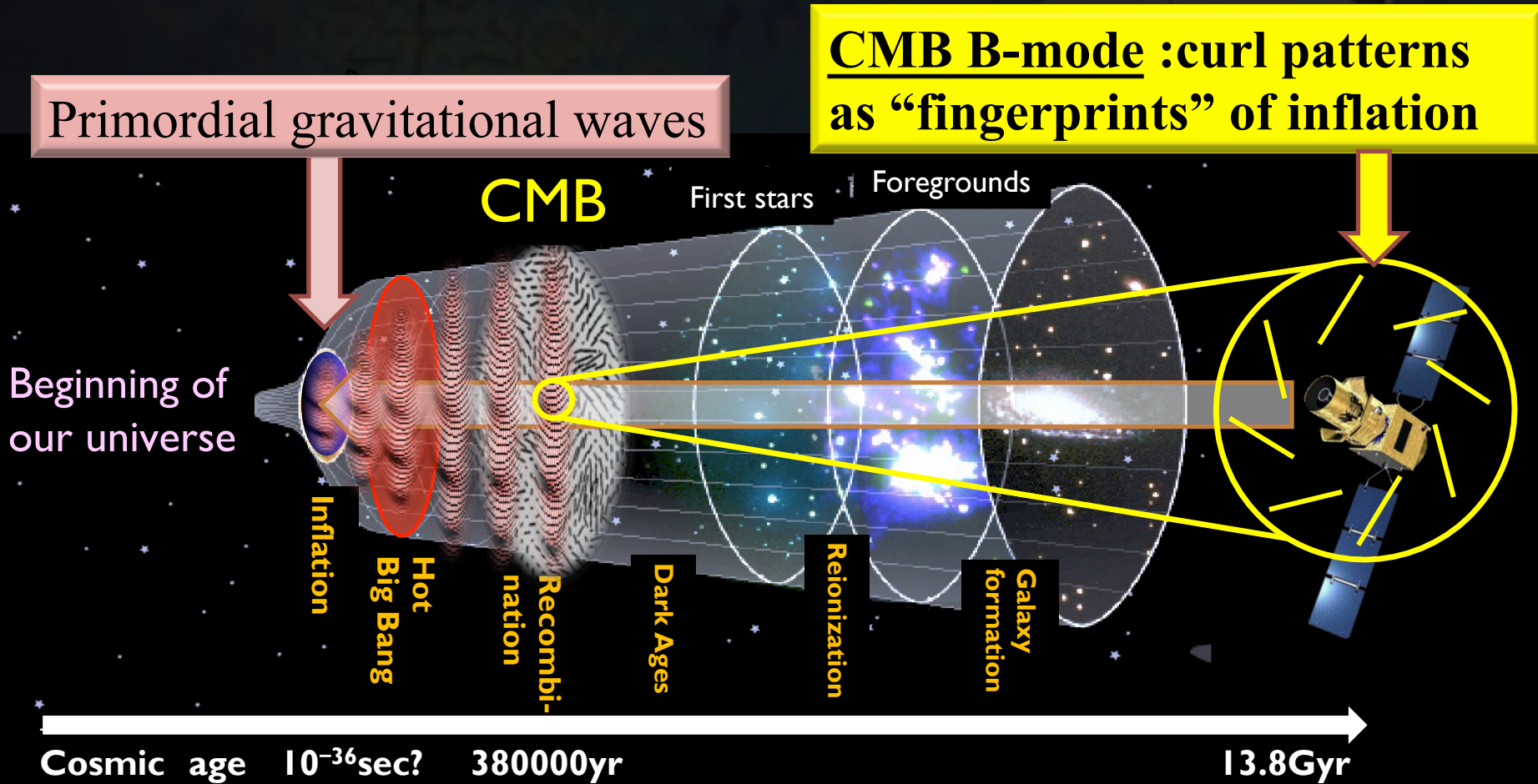
Physics of CMB B-mode

- Direct evidence for cosmic inflation
- GUT-scale physics

$$V^{1/4} = 1.06 \times 10^{16} \times \left(\frac{r}{0.01} \right)^{1/4} [\text{GeV}]$$

- Arguably the first observation of quantum fluctuation of space-time !

Probing cosmic inflation with CMB polarization



CMB B-mode is the best probe for primordial gravitational waves

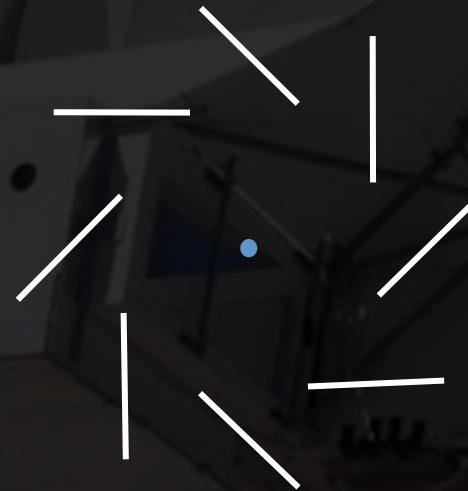
E-mode and B-mode

E-mode



Divergence,
even parity

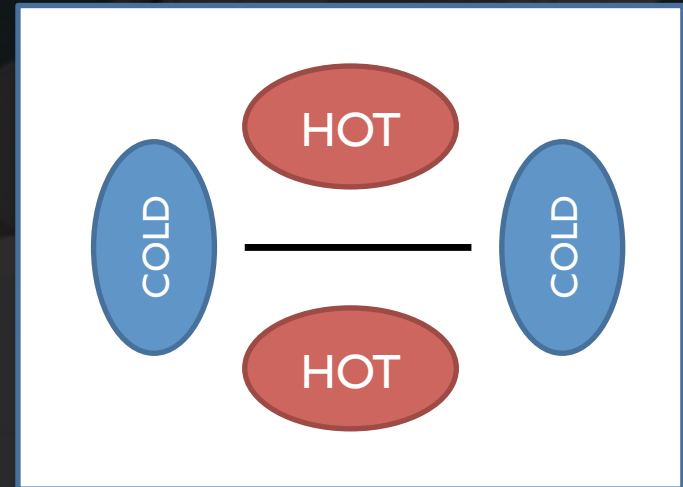
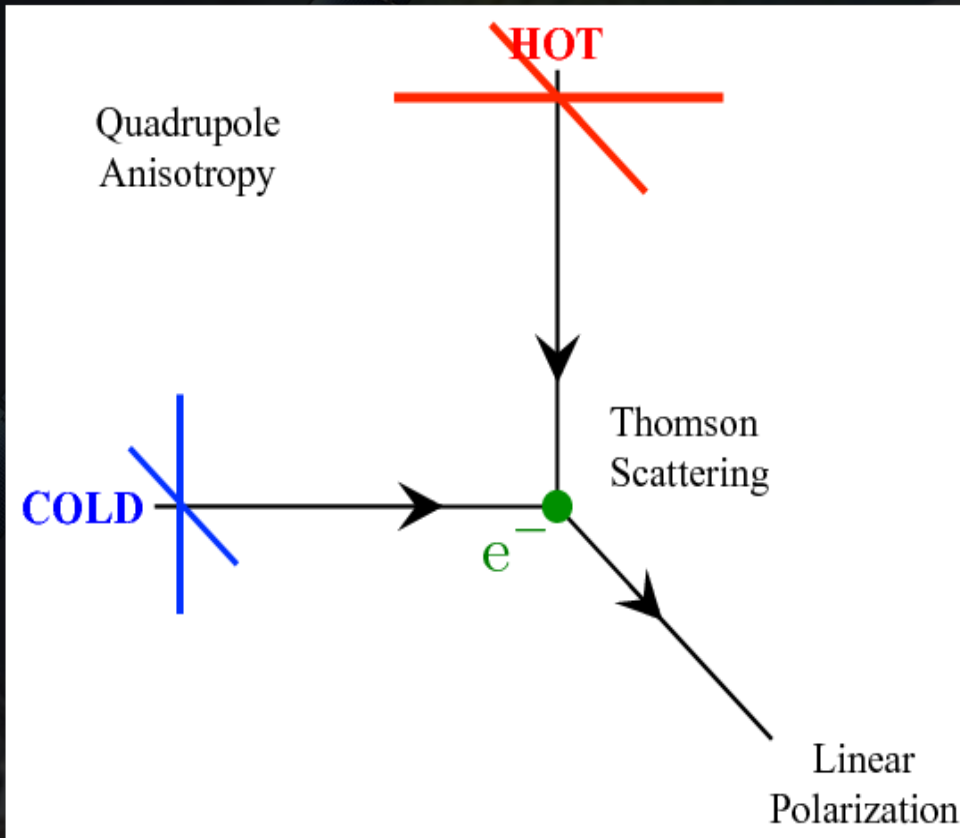
B-mode



Curl,
odd parity

Polarization map is decomposed into E-mode and B-mode.

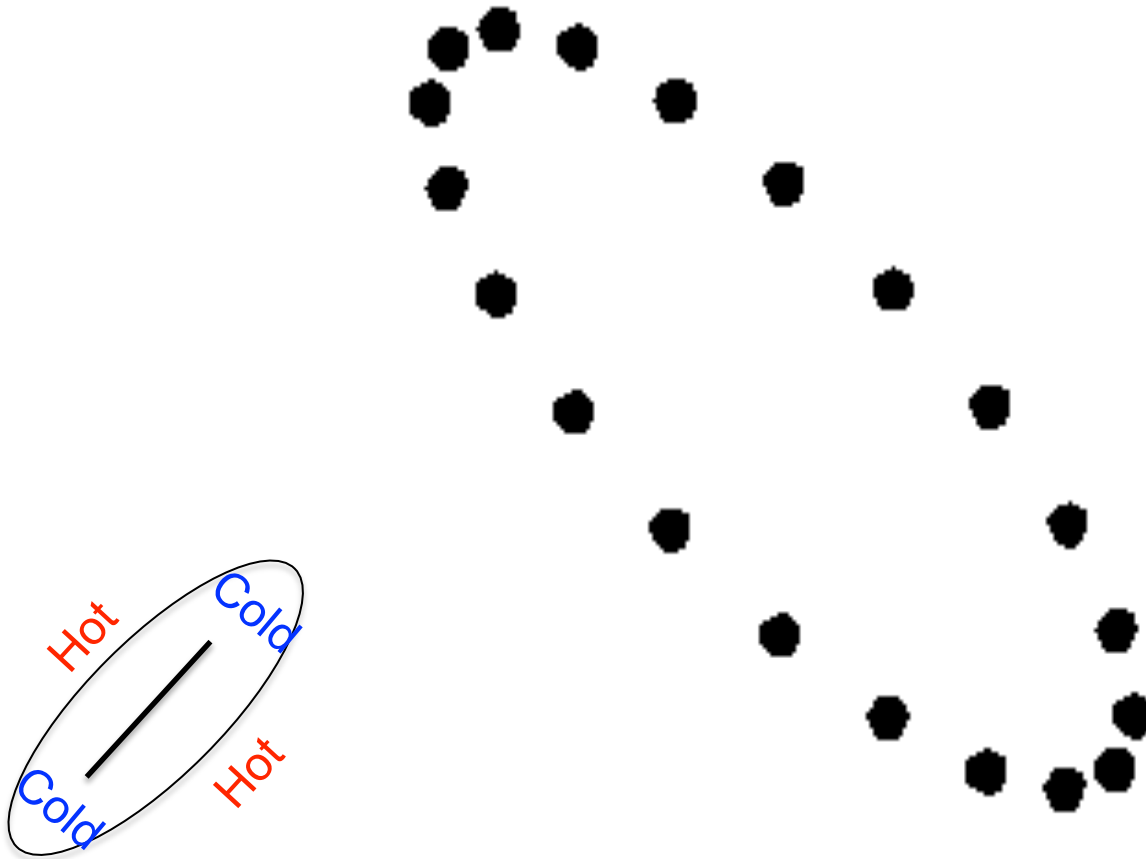
Physics at recombination

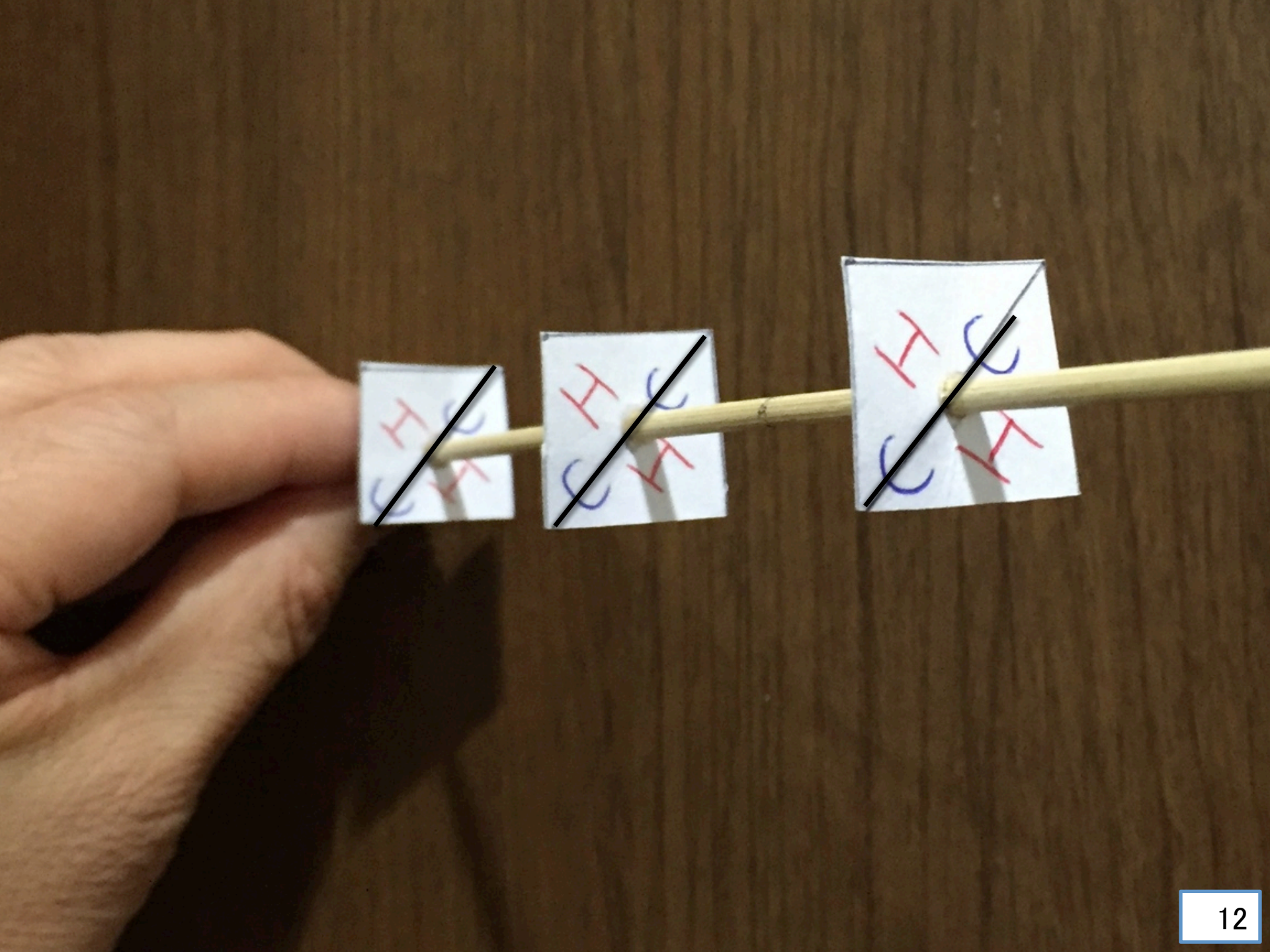


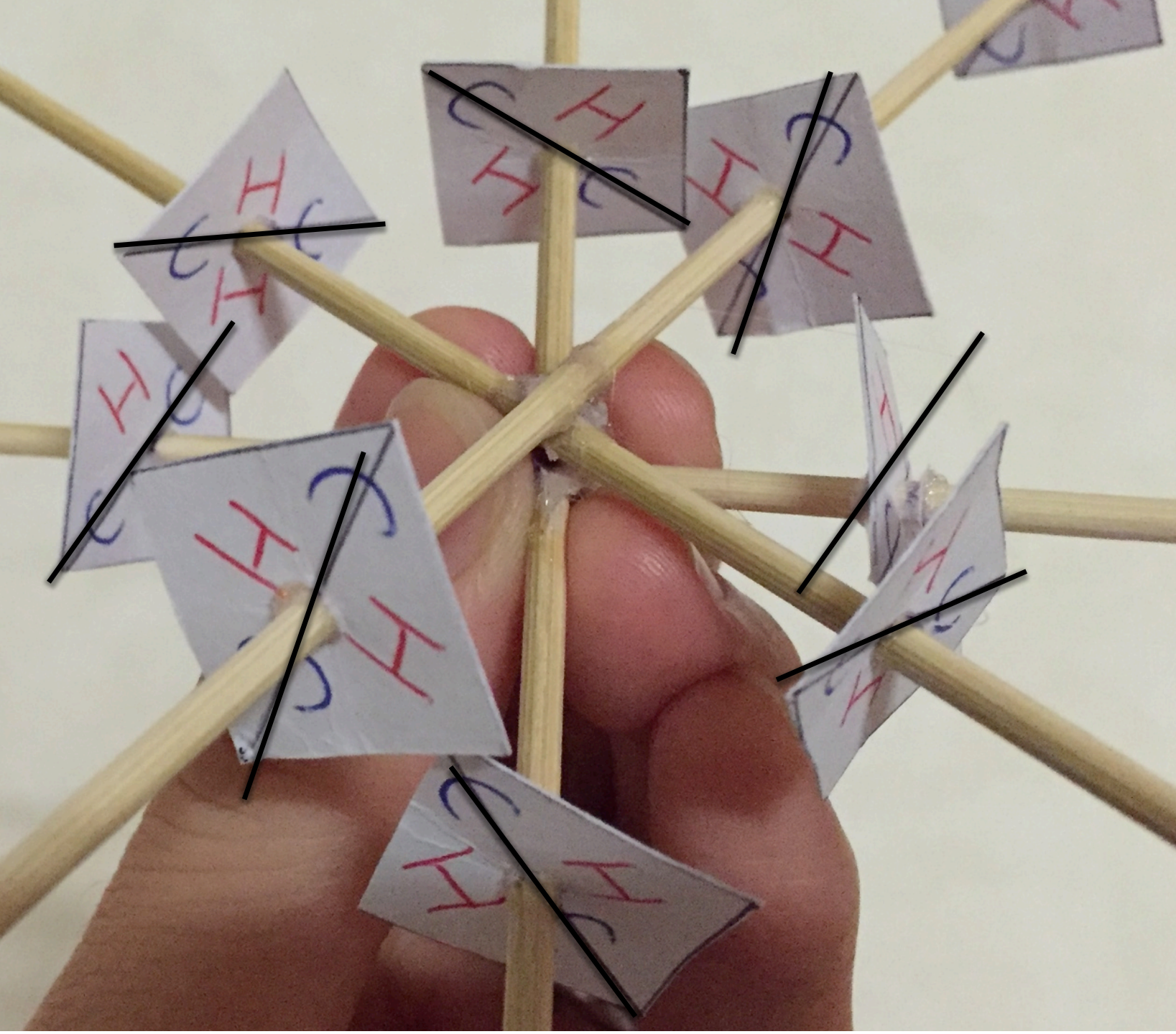
Local quadratic anisotropy in photon density around electrons results in CMB polarization.

This is just text-book physics.

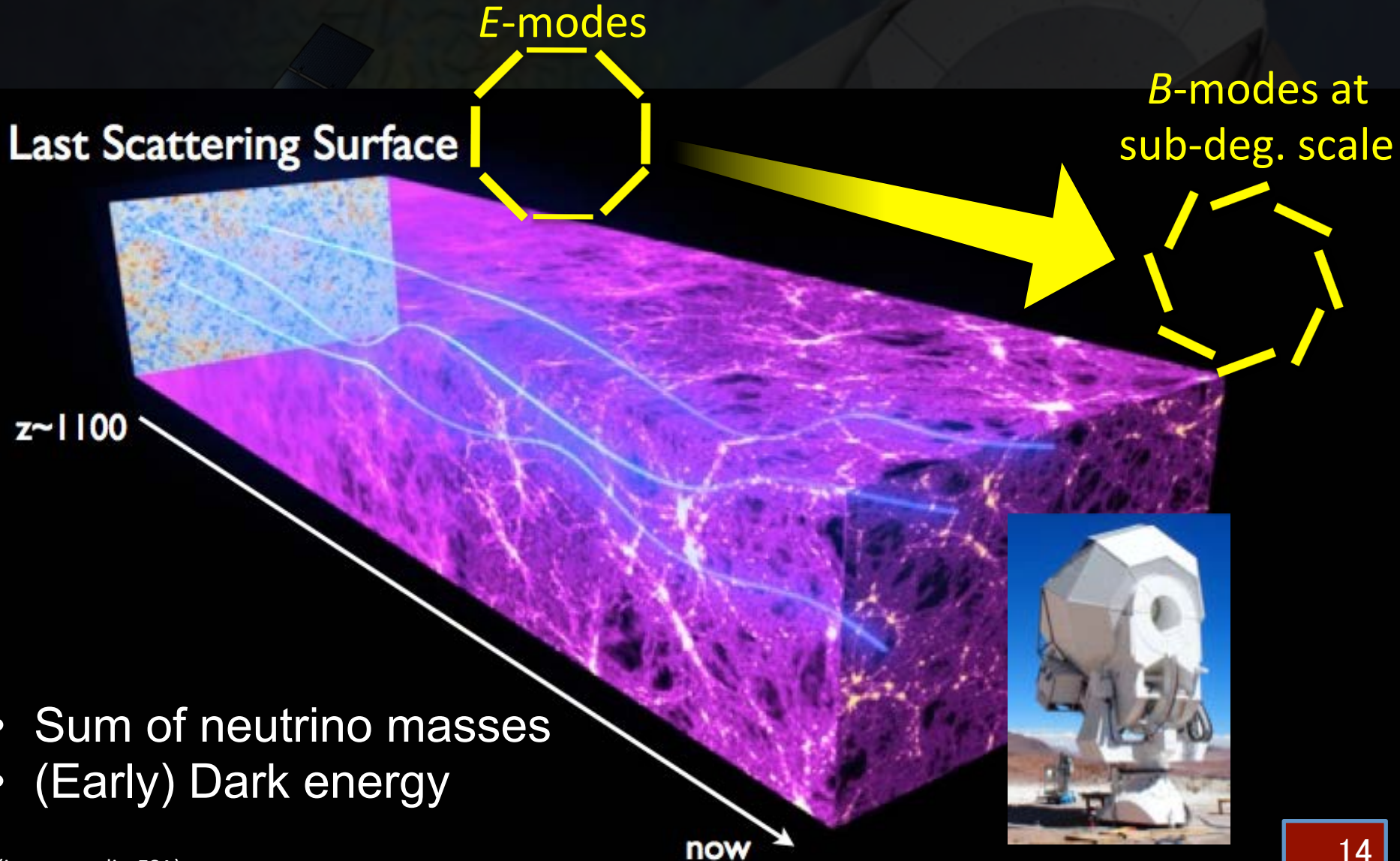
Gravitational waves

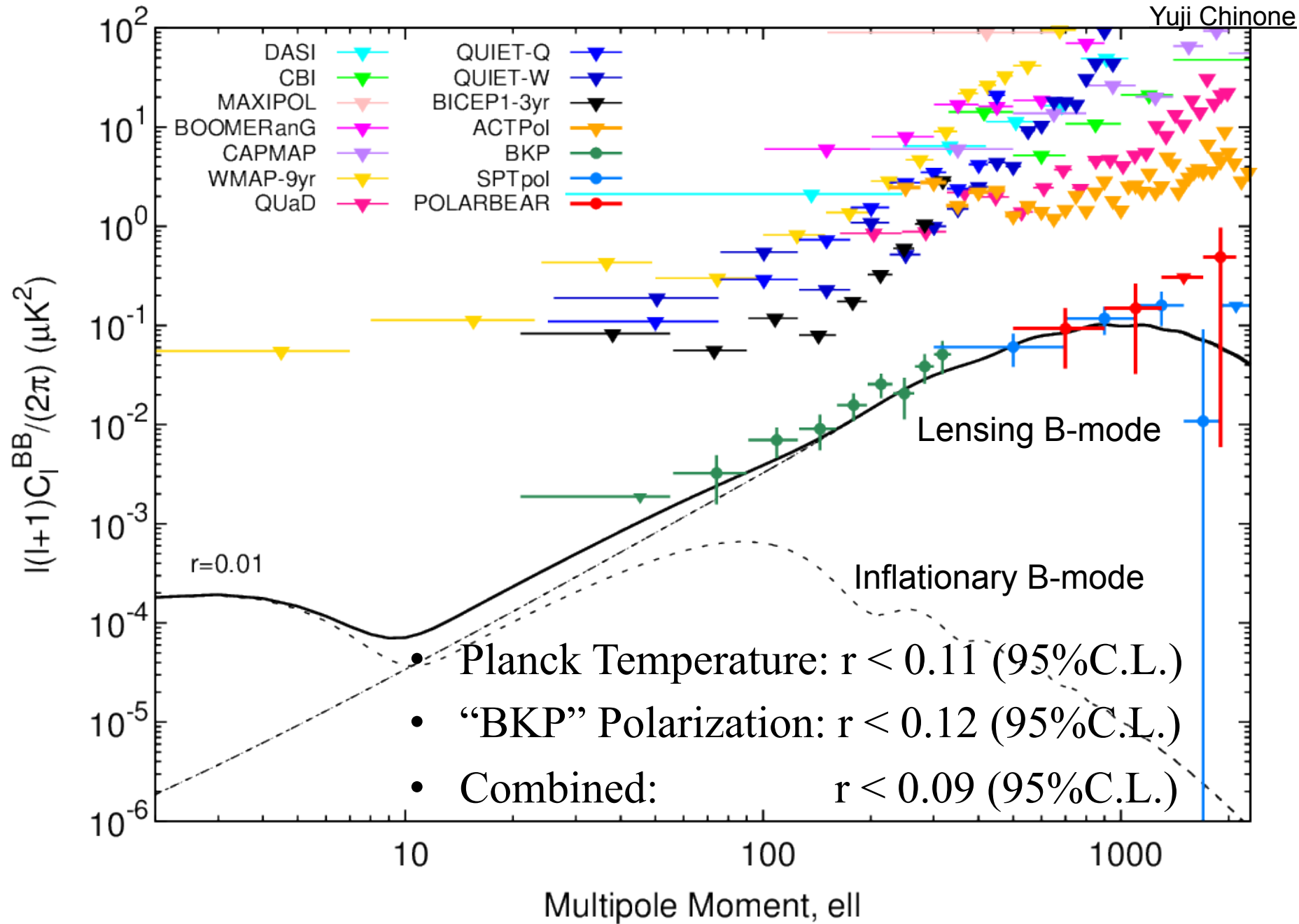






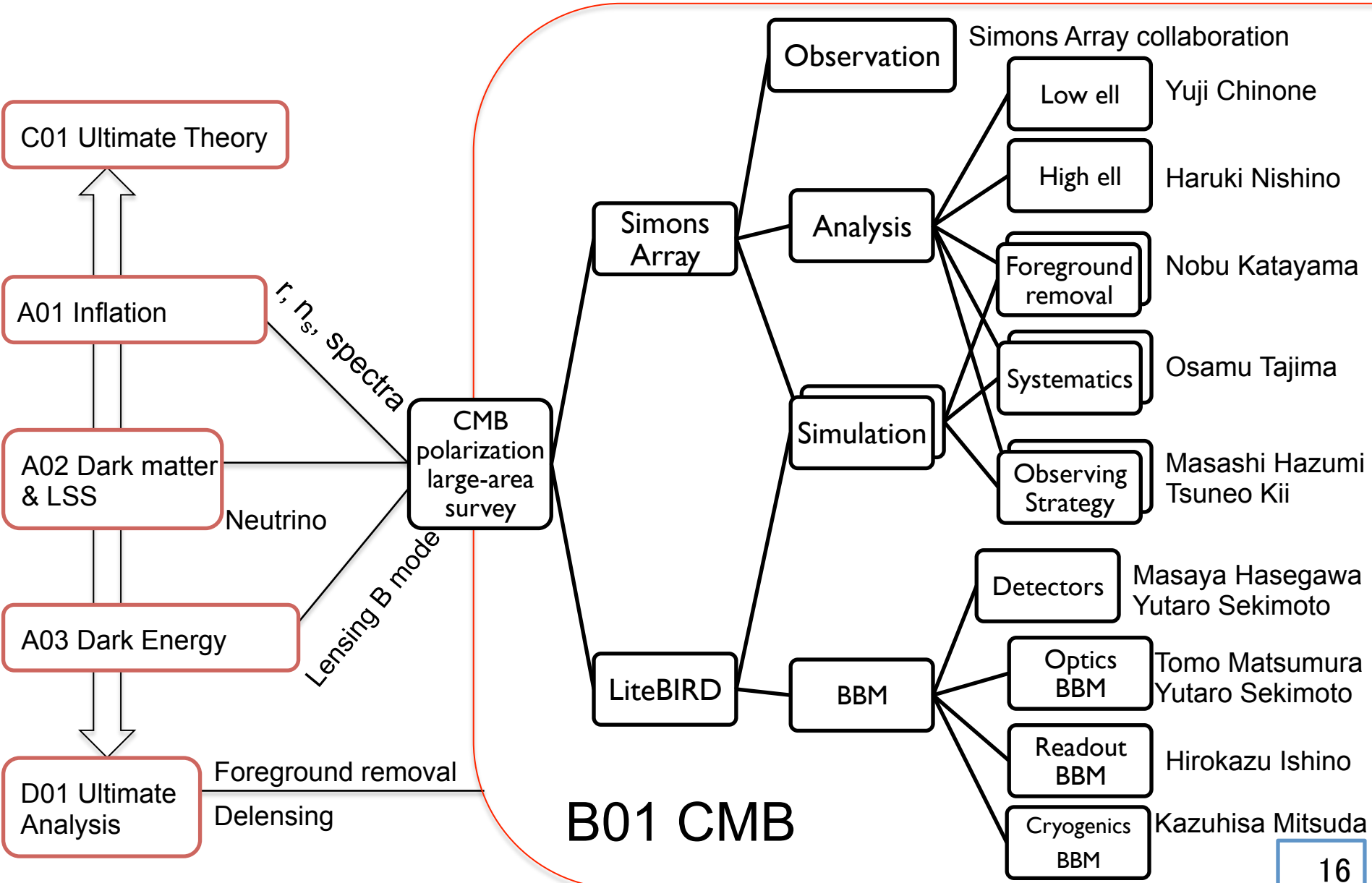
Lensing *B*-modes by *Weak lensing*





B01 Organization

Observations Projects Scope of B01 Tasks Personnel



Comments on B01-related Open Solicitation (公募研究)

- Categories E02 or E03
- Bold ideas contributing to B01 science goals welcome.
- Examples include
 - new instruments
 - new ideas on calibration and systematic error mitigation
 - new foreground separation methods

More talks on B01

- Masaya Hasegawa on Simons Array
- Tomo Matsumura on LiteBIRD
- Yuji Chinone on new POLARBEAR results and prospects with Simons Array and LiteBIRD



B mode from Space workshop @ Kavli IPMU, U.Tokyo, Japan

- Part 1: The Science goals, foregrounds, and status of CMB projects, (Dec 10 -12, 2015)
- Part 2: Mission design, technologies and challenges for the spaceborne observations (Dec 14 -16)
- The first meeting where LiteBIRD is focused on.
- <http://indico.ipmu.jp/indico/conferenceDisplay.py?confId=72>
- Everyone is welcome !
- Tentative program on the web
- We welcome poster presentations.

