

## 【Grant-in-Aid for Scientific Research (S)】

### Science and Engineering (Mathematical and Physical Sciences)



## Title of Project : Investigation of Inflation Cosmology with Ground-based Experiment of Large-angle Distribution of CMB B-mode Polarization

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Research Area : Mathematical and Physical Science

Keyword : Astrophysics (Experiment)

#### 【Purpose and Background of the Research】

The universe is thought to start from the Big Bang followed by the inflation where the time-space metric was drastically expanded, though the presence the inflation has not been proven yet. The inflation hypothesis can simultaneously solve the remained important problems of the cosmology such as the flatness, monopole, and horizon problems. One of its most important predictions is the presence of primordial gravitational waves. The best way to prove the waves is to discover the specific polarization pattern, “B-mode”, originated by the waves [1].

So far, many experiments have searched for the sign, and the BICEP2 experiment claimed the detection in March, 2014. However, after the careful examination of the signal combined with the Keck and Planck observations, the signal can be affected by the galactic dust emission [2]. Thus, the discovery has not been established yet [3].

In this research, we will perform the widest ground-based experiment, GroundBIRD, of the B-mode signal by covering more than 25 times greater than the previous observations (Fig. 1). The purpose is to discover the signal by investigating the widest spatial frequency range of the spatial spectrum of the B-mode.

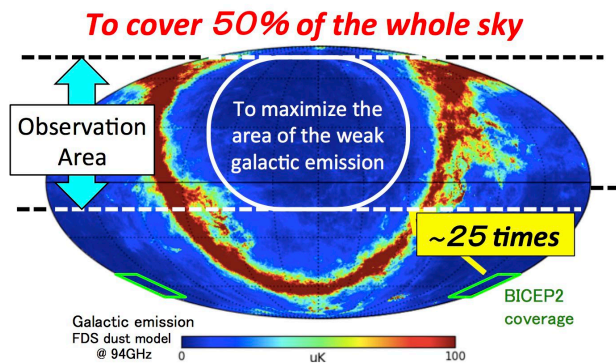


Fig. 1. Observation area of GroundBIRD

#### 【Research Methods】

In this experiment, we will suppress the  $1/f$  noise, the systematic errors, and the leakage from the galactic dust emission. To achieve them, we will apply (1) the rapid telescope rotation, (2) 2

bands (145 and 220 GHz) simultaneous observations, (3) the cryogenic optics and high-sensitivity detector, MKIDs, and (4) the precise polarization measurements by using the wire-grid calibrator.

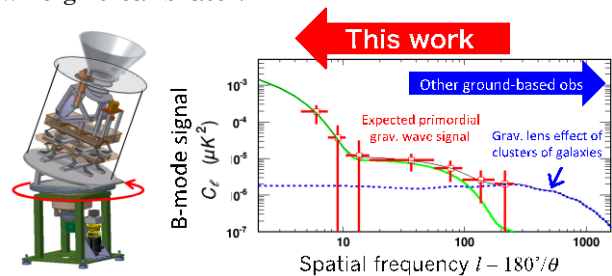


Fig.2. GroundBIRD telescope and expected B-mode signal by 3-year observations

#### 【Expected Research Achievements and Scientific Significance】

- To construct the GroundBIRD telescope and achieve the widest observations so far.
- To perform the two-band observations and minimize the systematic errors.
- To investigate the inflation theory by measuring the B-mode spectrum.
- To cover the north hemisphere

#### 【Publications Relevant to the Project】

- [1] L. M. Krauss, S. Dodelson, S. Meyer, Science, 328, 989-992 (2010).
- [2] P. A. R. Ade et al. (BICEP2 Collaboration), PRL 112, 241101 (2014).
- [3] P. A. R. Ade et al. (BICEP2/Keck and Planck Collaborations), PRL 114, 101301 (2015).

#### 【Term of Project】 FY2015-2019

#### 【Budget Allocation】 153,200 Thousand Yen

#### 【Homepage Address and Other Contact Information】

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