

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

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



#### Title of Project : Study of the Extreme Universe with the CTA Large Size Telescopes

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Research Project Number : 17H06131 Researcher Number : 40197778

Research Area : Cosmic Ray Physics, High Energy Astrophysics

Keyword : Cosmic Rays, Gamma Rays, Black Holes, Super Nova Remnants, Dark Matter

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

The study of the high-energy Universe has been developed for the past few decades with ground-based Cherenkov telescopes and been established as an energy frontier in astrophysics. Further significant development is expected with the next generation telescopes CTA. CTA Japan is now constructing four Large Size Telescopes at La Palma, Spain, within the framework of an international collaboration. In this project, we start to produce scientific results using in the early stage of the CTA project these four Large Size Telescopes. Major research topics are 1) The first observation and study of Gamma Ray Bursts above 10GeV, 2) Study of the high-energy process around Active Galactic Nuclei, and Super Massive Black Holes, 3) Indirect Dark Matter Search with high energy gamma rays from Spheroidal Dwarf Galaxies and the Galactic Center.

#### 【Research Methods】

In the last decades, the gamma ray observation technique with imaging atmospheric Cherenkov telescopes has been established as an important new window in astrophysics. At present, more than 200 galactic and extragalactic sources are observed.

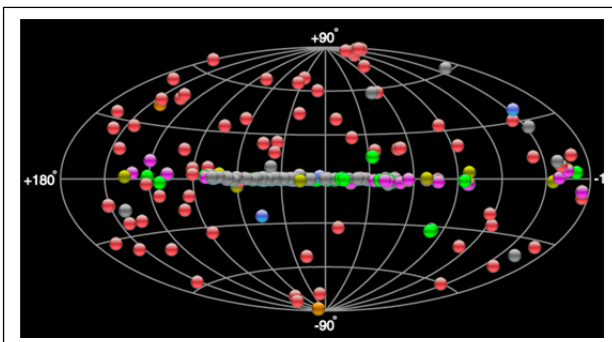


Figure 1: >100GeV Gamma Ray Sources in the galactic coordinate. Galactic sources are concentrated on the galactic plane and Active Galactic Nuclei are seen at high latitude.

We are planning to construct and operate the four large size telescopes, one by one, within three years. The array of four large size telescopes will be completed in FY2019 and will expand the visible

Universe with high energy gamma rays up to a redshift of  $z < 4$ . It will bring us extremely important insights into AGNs and GRBs. Furthermore, the search for the dark matter in the dwarf spheroidal galaxies and the Galactic Center is another important subject.



Figure 2: Artist view of the array of CTA Large Size Telescopes. Construction and operation will be realized one by one, and full operation will start in FY 2019.

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

This project will significantly advance the understanding of the high-energy Universe. It will also offer an international research environment to young scientists and make them global leaders in this field.

#### 【Publications Relevant to the Project】

- Introducing the CTA Concept, CTA Consortium, *Astropart. Phys.* 43 (2013) 3-18.
- Black hole lightning due to particle acceleration at subhorizon scales, MAGIC Collaboration, *Science*, 346 (2014) 1080-1084.
- Detection of very high energy gamma-ray emission from the gravitationally-lensed blazar QSO B0218+357, MAGIC Collaboration, *Astron. Astrophys.* 595 (2016) A68.

【Term of Project】 FY2017-2021

【Budget Allocation】 157,100 Thousand Yen

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

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