【Grant-in-Aid for Specially Promoted Research】

Science and Engineering (Mathematics/Physics)

Title of Project： Study of the Extreme Universe with High Energy Gamma Rays

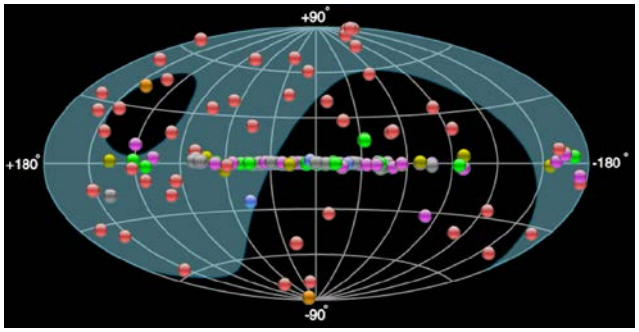
Masahiro Teshima
(The University of Tokyo, Institute for Cosmic Ray Research, Professor)

Research Area：Astroparticle Physics, Gamma Ray Astronomy
Keyword：Cosmic Ray (experiment), Astrophysics(Experiment)

【Purpose and Background of the Research】

Plenty and various high energy phenomena can be found in the Universe. Sometimes we can find phenomena with very fast time variations and extreme flares. The new generation GeV gamma ray satellite and TeV Cherenkov telescopes have opened a new window to the Universe. Especially TeV gamma rays, which are among the most energetic ones in the electromagnetic wave, are exceptionally well suited for letting us see the Universe, and their study has been established as a new important field of Astrophysics.

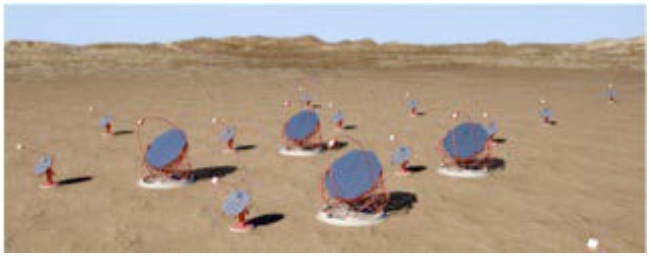
The new generation Cherenkov Telescopes, MAGIC, HESS and VERITAS, discovered more than 150 galactic and extragalactic sources of various types. These data gradually deepen the understanding of the origin of cosmic rays, non-thermal phenomena general in the universe, relativistic jets from Active Galactic Nuclei (AGN), and extragalactic background in the optical and infrared region.



【Research Methods】

With the MAGIC Cherenkov Telescope (50GeV -10TeV) and the Fermi Gamma Ray satellite (100MeV -100GeV) we observe many extreme objects and study cosmic ray acceleration and gamma ray radiation mechanisms with a unprecedented precision, using energy spectra over five decades. The final purpose is to clarify the origin of cosmic rays, and to draw a global picture of cosmic rays extending over more than eleven decades of energy.

Furthermore, we will build the first CTA Large Size Telescope with a 23m diameter (prototype) in the framework of an international collaboration and extend the gamma ray horizon toward the deep Universe up to a redshift parameter of z <3.



【Expected Research Achievements and Scientific Significance】

We survey the major super nova remnants and the large scale structure at the galactic center, and clarify the origin of galactic cosmic rays. We also observe Active Galactic Nuclei (AGN,) as many as possible, and aim to achieve the first observation of a Gamma Ray Burst (GRB) in the highest energy regime.

We carry out high precision measurements of extragalactic background light using gamma rays from distant AGNs and GRBs, and study the history of star formation and the structure formation of the Universe. Furthermore, we will perform a deep observation for gamma rays from dark matter annihilation at the center of our galaxy and satellite dwarf spheroidal galaxies.

【Publications Relevant to the Project】

Design Concepts for the Cherenkov Telescope Array, CTA Consortium (M. Actis, M. Teshima et al.), Exp. Astronomy 32 (2011) 193-316.

【Term of Project】

FY2012-2016

【Budget Allocation】

405,000 Thousand Yen

【Homepage Address and Other Contact Information】

http://www.cta-observatory.jp
http://www.icrr.u-tokyo.ac.jp/~mteshima/
mteshima@icrr.u-tokyo.ac.jp