Observatory and Facility

Kashiwa Campus Research Center for Cosmic Neutrinos

Kashiwa-City,
Chiba-Prefecture

Kamioka Observatory

Kamioka, Hida-City,
Gifu-Prefecture

KAGRA Observatory

Kamioka, Hida-City,
Gifu-Prefecture

High Energy Astrophysics Facility in Canarias

La Palma,
Canary Islands, Spain

Norikura Observatory

Nyukawa-cho, Takayama-City,
Gifu-Prefecture

Akeno Observatory

Akeno-cho, Hokuto-City,
Yamanashi-Prefecture

Institute for Cosmic Ray Research

The University of Tokyo

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Institute for Cosmic Ray Research (ICRR)
The University of Tokyo
5-1-5 Kashiwanoha, Kashiwa-City, Chiba-Prefecture 277-8582 Japan
URL : https://www.icrr.u-tokyo.ac.jp

ICRR aims to solve the problem of the Universe and particle physics through the observation of high-energy charged particles (cosmic rays), gamma rays, neutrinos, gravitational waves, etc. from the outer space.

ICRR
Institute for Cosmic Ray Research
University of Tokyo

What is Cosmic Ray?

"Cosmic rays" are particles that travel from the Universe to the Earth with high energy. Since their discovery in 1912, various research has been carried out with the aim of elucidating their origins and acceleration mechanisms. In the initial cosmic ray research, "cosmic rays" were charged particles such as protons and helium nuclei, but in recent years, uncharged elementary particles such as neutrinos, gamma rays and gravitational waves (gravitons) are also considered to be "cosmic rays," broadening the scope of cosmic ray research. Since cosmic rays travel over long distances, larger than the size of the Earth, and are accelerated to extremely high energies, they facilitate research on elementary particles that cannot be conducted in accelerator experiments on the ground. ICRR conducts fundamental research on the Universe and elementary particles using cosmic rays.

History of ICRR

The history of ICRR began with a cosmic ray observation hut called Asahi Hut on Mt. Norikura at an altitude of 2,770m. This small hut, built in 1950 with science project funding from the Asahi Shimbun, developed into the Cosmic Ray Observatory (commonly called Norikura Observatory) of The University of Tokyo in 1953. It was the first inter-university research facility in Japan. The Cosmic Ray Observatory was then reorganized to become the Institute for Cosmic Ray Research (ICRR) of The University of Tokyo in 1976. Since then, ICRR has carried out various research activities on cosmic rays as an inter-university research institute.

Organization of ICRR

ICRR has three research divisions—the Neutrino and Astroparticle division, the High Energy Cosmic Ray division, and the Astrophysics and Gravity division—in order to conduct these scientific activities effectively. ICRR has four observatories in Japan; Kamioka Observatory (underground in Kamioka, Gifu Prefecture), KAGRA Observatory (underground in Kamioka, Gifu Prefecture), Norikura Observatory (2,770 meters alt., Mt. Norikura, Gifu Prefecture) and Akeno Observatory (Yamanashi Prefecture), and one research center (Research Center for Cosmic Neutrinos, Kashiwa, Chiba Prefecture). In addition, there are four observation facilities outside Japan, located in Utah, USA, Yangbajing in Tibet, China, High Energy Astrophysics Facility in Canarias (La Palma, Spain), and Chacaltaya, Bolivia. ICRR is an "International Joint Research/Usage Center," which is a system of the Japanese government, and over 150 inter-university research programs have been carried out at ICRR by cosmic ray researchers in Japan and other countries.

Experimental Facilities

We have many Large-scale Equipments.

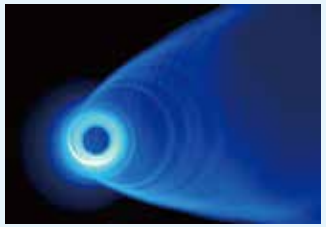
High Energy Cosmic Ray Research

Cherenkov Telescope Array Group

This group aims to explore the extreme Universe with the next-generation very-high-energy gamma-ray observatory CTA, which has higher detection sensitivity and broader energy coverage by order of magnitude than current telescopes. The discovery of thousands of gamma-ray objects, such as black holes and neutron stars, is expected.

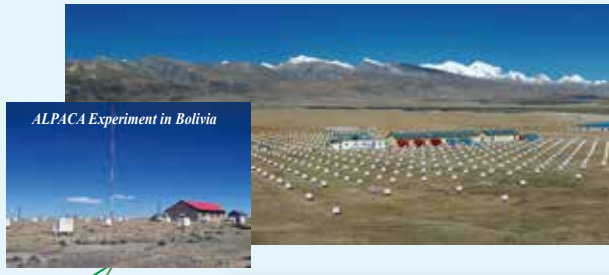
High Energy Astrophysics Group

This group theoretically studies high-energy astrophysical phenomena, such as formation of relativistic jets, particle acceleration, and emission mechanisms, with electromagnetic radiations, cosmic rays, neutrinos and gravitational waves.



Tibet AS γ / ALPACA Experiment Group

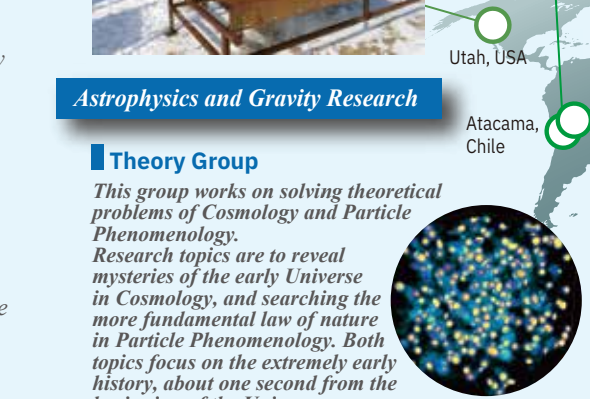
This group deploys air shower detectors studying ultra high energy cosmic gamma rays and very high energy cosmic rays both at Tibet heights, China (altitude: 4300m) and at heights near Mt. Chacaltaya, Bolivia (altitude:4740m) to find out origin of cosmic rays around 10^{15}eV energies and how they are accelerated.



ALPACA Experiment in Bolivia

Telescope Array Group

This group aims to find out where the extremely high energy cosmic rays; around 10^{20}eV come from.



Neutrino and Astroparticle Research

Super-Kamiokande Group
Hyper-Kamiokande Group

Construction Scene of Hyper-Kamiokande

Super-Kamiodane(SK) and Hyper-Kamiokande(HK) groups aim to reveal the history of the Universe and explore the nature of elementary particles through the observation of neutrinos and the discovery of proton decay.SK is upgrading to SK-Gd with increased sensitivity for anti-electron neutrinos starting in 2020. HK, with about ten times the effective volume of SK, will start its operation in 2027.

Astrophysics and Gravity Research

Theory Group

This group works on solving theoretical problems of Cosmology and Particle Phenomenology.
Research topics are to reveal mysteries of the early Universe in Cosmology, and searching the more fundamental law of nature in Particle Phenomenology. Both topics focus on the extremely early history, about one second from the beginning of the Universe.

Observational Cosmology Group

This group aims to explore the early Universe by deep multi-wavelength observations with the state-of-the-art telescopes such as Subaru Telescope, ALMA,and James Webb Space Telescope. Research purpose is to understand physical processes of galaxy formation at the early stage and the relevant event of cosmic reionization.

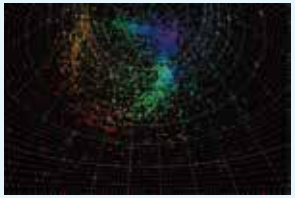
Gravitational Wave Group

This group aims to promote gravitational wave astronomy by participating the global gravitational wave observation network with the large- scale cryogenic gravitational wave telescope, KAGRA.

Dark Matter Direct Detection Group

What are the material constituents of the Universe? This is one of the most fundamental questions, and we know that most of them are NOT atoms or molecules but something called dark matter. This group aims at detecting dark matter particles directly.

T2K Experiment Group



T2K is a neutrino experiment designed to study how neutrinos change as they travel (neutrino oscillations) with an intense muon-neutrino beam generated at J-PARC and the Super-Kamiokande as a far detector.