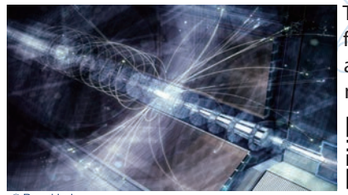
Envisioning the future

International Linear Collider Plan



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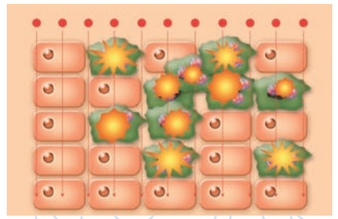
The International Linear Collider (ILC) is a proposed future particle accelerator that will smash electrons and their antimatter particles, positrons, together at nearly the speed of light, producing alleys of new particles. The main aim of the ILC is the precision study of the Higgs Boson. Physicists from around the world have agreed on the significance of a Higgs Factory, an accelerator designed to produce Higgs bosons at a high rate. The ILC is regarded as a Higgs Factory with a technically mature design.

New cancer treatment using accelerators



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Boron neutron capture therapy (BNCT) targets cancer cells by taking advantage of the fact that boron reacts easily with neutrons. As boron is incorporated into cancer cells, which are then irradiated with neutrons from outside the body and can be treated without surgery. Neutron beams are generated by accelerators which can be installed in hospitals or other facilities. We are developing accelerators to promote accelerator-based BNCT.

Human resource development

KEK is one of the core research institutes of the Graduate University for Advanced Studies (SOKENDAI). KEK also cooperates with university researchers to educate graduate students of other institutions. The program at KEK includes particle and nuclear physics, accelerator science, and material structure science.

Industry-academia collaboration and social contributions

Innovations developed by KEK have a broad societal impact. We conduct joint research with private companies and engage in knowledge transfer to industry through programs such as the Tsukuba Innovation Arena (TIA) which includes research institutes and other organizations in Tsukuba City.

SDGs (Sustainable Development Goals)

KEK promotes activities of research, education, social contribution with a strong awareness of SDGs such as education, energy and peace.

Overview of KEK

Name	Inter-University Research Institute Corporation High Energy Accelerator Research Organization
Establishment	The precursor of KEK, National High Energy Physics Institute, was established in 1971.
Address	Tsukuba Campus 1-1 Oho, Tsukuba, Ibaraki 305-0801 Japan 029-879-6047 (Public Relations Office) Tokai Campus 203-1 Shirakata, Tokai-mura, Naka-gun, Ibaraki 319-1106 Japan 029-284-4851 (General Affairs Section)
Number of Users (FY2023)	Total number of users is 49,788 (Including 15,854 users from institutes overseas)
Budget (FY2024 plan)	About 40.5 billion
Number of staff (April First, 2024)	Executive and Employee 1,122 people (fixed term employee included)
Web Site	https://www.kek.jp/en/

The J-PARC Main ring at Tokai-mura, Ibaraki

Insight through Accelerators.

High Energy Accelerator Research Organization (KEK) looks into the world of molecules, atoms, and elementary particles using accelerators that act as "huge microscopes".

Videos and detailed information are available by scanning the 2D codes.

Donations are welcome - Building the future together!

We accelerate education, research and social contribution activities to spread "Insight through Accelerators". We value your engagement for development in science and technology.

Social Media @kek_jp @KEK.JP

Issued in January, 2025

https://www.kek.jp/en/

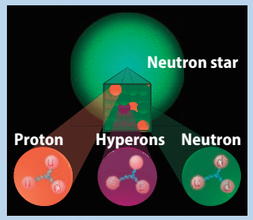
KEK Inter-University Research Institute Corporation
High Energy Accelerator Research Organization

Look into with accelerators

The ancient symbol of a snake swallowing its own tail, known as an ouroboros, represents the eternal cycle of destruction and rebirth. KEK aims to observe the origin of the universe through microscopic particles in nature. At KEK, this connection is realized with advanced accelerators.

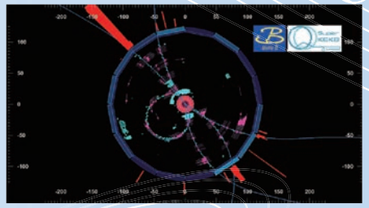
Insight into origin of the universe

Understanding the force that forms nuclei



Hadron experiments at J-PARC investigate the interactions of "strange particles" called hyperons, heavier cousins of protons and neutrons containing strange quarks. This study provides insight into the formation of matter in the early universe and the inner structure of neutron stars, which can be regarded as giant nuclei containing hyperons.

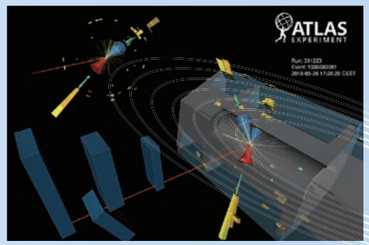
Searching for New Physics phenomena to unravel the mysteries of the universe



The Belle II experiment is searching for New Physics phenomena that could hold the key to solving the mysteries of the universe by precisely studying the decays of particles produced by SuperKEKB, an electron-positron† collider at KEK.

†A positron is the anti-particle of an electron.

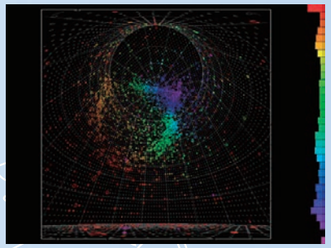
Probing the mysteries of the early universe using the world's largest accelerator



ATLAS Experiment © 2021 CERN

The ATLAS experiment studies collisions of protons provided by the Large Hadron Collider (LHC) – the world's highest energy particle collider, located at CERN. The energy of these collisions produces conditions similar to those of the early universe and allows the experiment to search for new particles and phenomena that shaped the primordial universe.

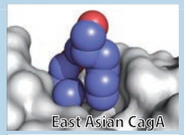
Using neutrinos to investigate the disappearance of anti-matter from the universe



© The T2K Collaboration

In the early universe antimatter should have been as abundant as matter according to current theories. The J-PARC facility in Ibaraki prefecture fires beams of neutrinos towards the Super-Kamiokande detector 295 km away in Gifu prefecture - the T2K (Tokai-to-Kamioka) experiment aims to solve the mystery of antimatter's disappearance by studying these neutrinos and antineutrinos.

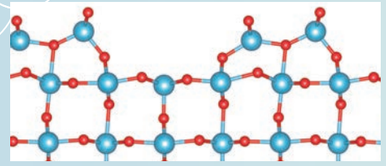
Why is stomach cancer common in Asia?



The structural analysis using synchrotron radiation X-rays revealed that CagA, a kind of protein, produced by Helicobacter pylori in East Asia bind tightly to oncoproteins in the stomach and advance on to cancer. In contrast, CagA from Europe and the United States bind loosely. This may explain why stomach cancer is so prevalent in Asia.

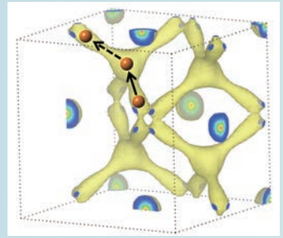
Insight into structure of materials

Surface asymmetry in photocatalyst structures



Photocatalysts work on surfaces exposed to light. Titanium dioxide, a commonly used photocatalyst, had a surface whose atomic arrangement was not previously well-understood. However, by utilizing the "total reflection" phenomenon of a positron beam injected at shallow angles, researchers revealed an unexpectedly asymmetrical surface atomic arrangement.

Electricity flowing in future batteries



All-solid-state batteries are expected to be durable next-generation batteries. The diagram on the right shows that the neutron diffraction experiment can unveil atomic arrangements and ion flows in a fluoride-ion conductor, which is a promising solid electrolyte for fluoride-ion batteries. This experiment provides valuable insights for future technologies.

The gold and silver used for Tempo oval coins

Precious artifacts that are too delicate to handle can be analyzed with a non-destructive method using negative muons. An examination using muon characteristic X-rays reveals that Tempo Koban gold coins from the Edo period contain a significant amount of silver beneath the surface. This technique, not to be confused with gold-plating, is known as 'irotsuke' (coloring) and reflects the unique craftsmanship attributed to the Kinza (gold mint) during that era.

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Insight into the mysteries of life