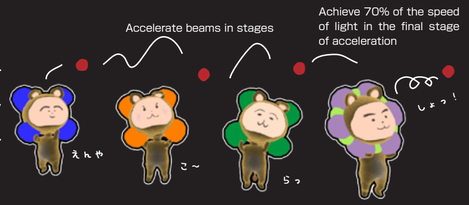
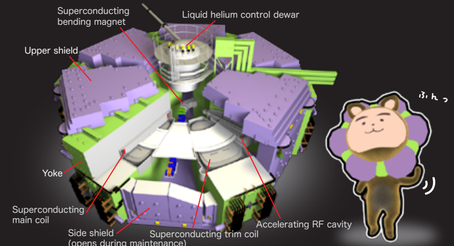
Amazing Facts about RIBF!

その1 Multistage accelerator

The RIBF is a multistage accelerator complex where ion beams are accelerated in stages by connecting several accelerators. This allows nuclei to be accelerated up to 70% of the speed of light, making it possible to achieve world's most powerful beam intensity. RIKEN's technology accumulated over many years has made this possible.



その2 The Secret of the SRC, the Most Powerful Accelerator in History

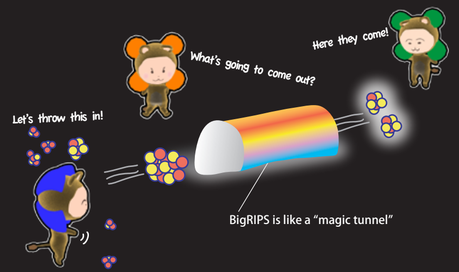


Structure of SRC
6基の扇形のセクター（緑色）とシールド（紫色）からなっている。

Superconducting Ring Cyclotron(SRC), the flagship cyclotron in the RIBF that boasts world's most powerful beam intensity, is a huge "mass of iron" that weighs 8,300 tons, about twice the weight of Tokyo Tower.
We succeeded in constructing a superconducting ring cyclotron for the first time in the world by an innovative idea of sealing it entirely by pure iron. Moreover, the utilization of superconductivity drastically reduces the energy consumed down to 1/100 of the conventional accelerators.

その3 About 4000 species of nuclei can be used at RIBF

Atomic nuclei accelerated up to 70% of the speed of light go through BigRIPS, a magic tunnel, and comes out transformed into different nuclei. This happens because in the magic tunnel, nuclei are destroyed while traveling in the tunnel. Amazingly, approximately 4,000 species of nuclei are created in the process! The secret behind such a huge variety lies in uranium beam which we succeeded in injecting into the tunnel.



Example of research results and application study

First element discovered in Asia, synthesized in Japan

Research Results

Discovery of a new element, "nihonium (Nh)"

"nihonium" is already listed in Periodic Table of the Elements" issued by The Ministry of Education, Culture, Sports, Science and Technology.

The Nishina Center succeeded in discovering the unconfirmed new element 113"nihonium". Since the probability of synthesizing a new element is extremely small, the search for a desired element is a difficult and painstaking process. Russia and Japan are currently competing to discover a new element. To discover element 113, it was necessary to 2collide atomic nuclei more than 100 trillion times.
With this discovery, we were given the naming rights for element 113, named it "nihonium" with its symbol "Nh", making Japan the first country in Asia to name an atomic element.

Application Research

An international heavy-ion breeding research consortium

An international heavy-ion breeding research consortium has been organized, with 156 national user groups and 15 international institutes in 2012. The advantages of heavy-ion mutagenesis include, a wide spectrum of mutations and induction of high mutation rate even at a low dose. The ion beam used usually changes only one characteristic. A new variety thus can be obtained by selecting a mutant that exhibits modified traits while retaining the existing valuable traits. This approach has been particularly successful in flower breeding. Since 2001, the consortium has introduced 22 new cultivars of plants and 2 of microbes to the market in Japan, the USA, Canada, and the EU. It took only two to three years to develop these new varieties.

"Nishina Homare, a new brand of Japanese sake created by using new brewing yeast produced via ion-beam irradiation.

New breed of cherry blossoms "Nishina Otome"(right) and "Nishina Zao"(left)
New breed of cherry blossoms developed by heavy ion beam technology: "Nishina Otome" blooms in all four seasons and "Nishina Zao" bears pale-yellow flowers.

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Global research base for RIBF science

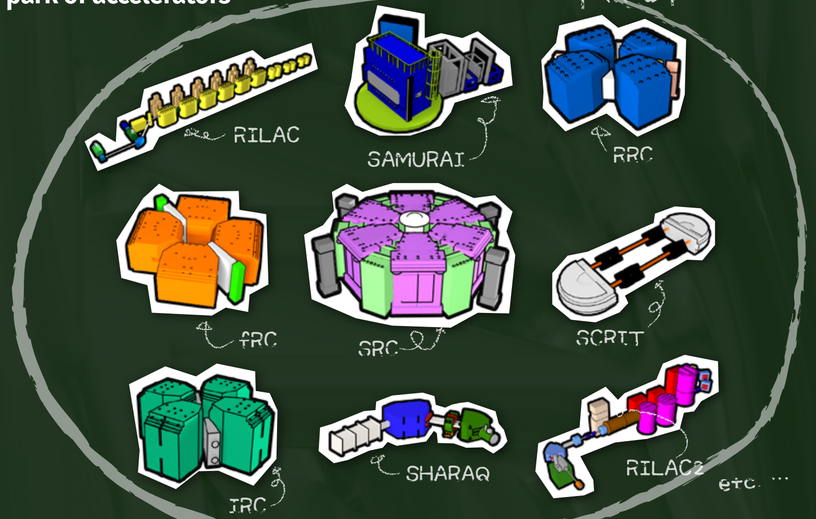
RIKEN NISHINA CENTER

All about

RI BEAM FACTORY

Huge Underground Factory to Unravel the Mystery of the Origin of the Universe

Amazing facts about RIBF: ❶
"Multistage Accelerator" Like an amusement park of accelerators



Unravel the Mystery of the Origin of the Universe!

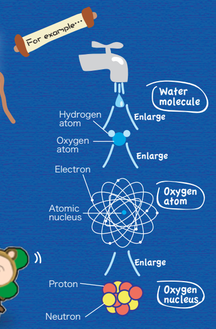
Amazing facts about RIBF: ❷
"World's most powerful accelerator" Culmination of the state-of-the-art technology

Amazing facts about RIBF: ❸
World's widest variety of nuclide used for modern alchemy

??? Investigate the atomic nucleus full of mystery

Everything is made of atomic nuclei.

As you can see in the diagram to the right, water, for example, is made of cluster of molecules. A water molecule is made up of hydrogen and oxygen atoms. An atom is made up of nucleus and electrons that orbit around it. The atomic nucleus is made up of protons and neutrons.



The origin of matter, atomic nuclei, is all mystery.

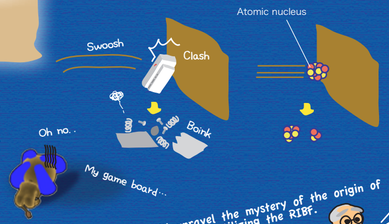
There are still so many mysteries about nuclei and their properties such as:

1. How are the lifetime, weight and size of a nucleus determined?
2. How are many protons and neutrons bound together in a nucleus?
3. How were heavy nuclei (such as uranium) formed in the universe?

There are still so many unknowns about the atomic nucleus such as its lifetime and how it was born.

Investigate the atomic nucleus by "destroying" it.

We conduct research to learn about the atomic nucleus by "destroying" it. Similar to breaking down/dismantling a machine to find out what goes on inside, atomic nuclei are destroyed by colliding them at super high speed. By investigating the destroyed fragments, we can determine their original structure.



We'll unravel the mystery of the origin of elements by utilizing the RIBF.

However!

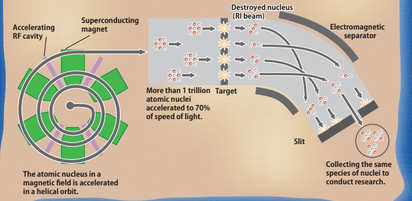
Destroying the nucleus is no easy task.

Yes!

First, the nucleus has to be accelerated to super high speed, up to 70% of the speed of light (equivalent to traveling five times around the Earth in one second). What made this all possible is the RIBF.

Acceleration principle of the cyclotron

Superconducting Ring Cyclotron (SRC) | Superconducting Radioactive Isotope Beam Separator (BigRIPS)



RI BEAM FACTORY 01

RRC RIKEN RING CYCLOTRON

The 1st stage Ring Cyclotron, the oldest cyclotron at RIBF.

Weight 2,300t
Diameter 12.6m

RI BEAM FACTORY 02

fRC FIXED-FREQUENCY RING CYCLOTRON

The 2nd stage Ring Cyclotron, essential for accelerating uranium.

Weight 1,500t
Diameter 10.8m

RI BEAM FACTORY 03

IRC INTERMEDIATE-STAGE RING CYCLOTRON

The 3rd -stage Ring Cyclotron that forwards the beam to the SRC and supply the beam to other apparatuses, too.

Weight 2,800t
Diameter 14.0m

RI BEAM FACTORY 04

SRC SUPERCONDUCTING RING CYCLOTRON

Final acceleration at the 4th stage of Ring Cyclotron, the most powerful cyclotron in the world with six superconducting magnets.

Weight 8,300t
Diameter 18.5m

We are studying the structure and reaction of nucleus using various apparatuses in RIBF.

Overall View of the RI Beam Factory