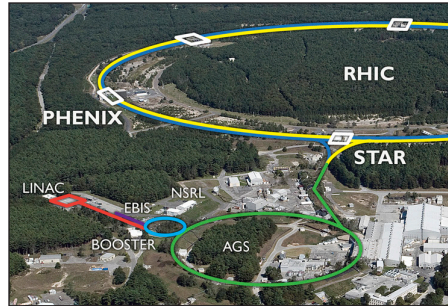


The Relativistic Heavy Ion Collider (RHIC) smashes particles together to re-create the conditions of the early universe, so scientists can explore the most fundamental building blocks of matter as they existed just after the Big Bang. This research unlocks secrets of the force that holds together 99 percent of the visible universe—everything from stars to planets and people—and triggers advances in science and technology that have applications in fields from medicine to national security.

## RHIC by the Numbers

Particle Collider Used to Explore the Fundamental Building Blocks of Matter



The RHIC accelerator complex at Brookhaven Lab, including a portion of the 2.4-mile-round RHIC ring

- The Relativistic Heavy Ion Collider (RHIC) at Brookhaven Lab ring is 2.4 miles in circumference and is visible from outer space.
- RHIC’s beams travel at 99.995 percent the speed of light (186,000 miles per second, or 300,000,000 meters per second).
- RHIC’s beams are not continuous—they are made of up to 111 separate “bunches,” each containing billions of ions.
- RHIC ions make 80,000 trips around the ring every second, with beam lifetimes of up to 10 hours.
- Thousands of RHIC collisions take place each second. Each head-on collision sends out a shower of thousands of subatomic particles to detectors.
- RHIC ions are so small that, even at nearly the speed of light, the force of their impact is about the same as the impact of two mosquitos colliding.
- RHIC’s two crisscrossing rings are made up of 1,740 superconducting magnets strung end-to-end like beads on a necklace.
- RHIC is powered by more than 13,000 miles of superconducting niobium-titanium wire wrapped around the RHIC magnets.
- To make RHIC’s magnets carry electricity without resistance, they are cooled by liquid helium to -452 degrees Fahrenheit, nearly absolute zero (-459°F, or -273°C)—the coldest anything can be.
- In all, RHIC contains 25 tons of helium—enough to fill all the balloons in the Macy’s Thanksgiving Day Parade for the next 400 years.
- To chill the helium, RHIC’s refrigerators draw nearly five megawatts of electricity. With energy-saving measures, cooling RHIC today requires half the power compared to when it started running in 2000.
- The temperature inside a RHIC collision reaches four trillion degrees Celsius—250,000 times hotter than the center of the Sun.
- RHIC collisions pack so much energy that it would be like stuffing all the energy consumed in the U.S. for one year into a cube with sides measuring one quarter the width of a single human hair.
- The super-hot, super-dense matter formed at RHIC lasts less than ten millionths of a billionth of a billionth of a second (0.00000000000000000001 second).
- Experiments at RHIC reveal that this super-hot matter is actually a *liquid* with very low viscosity, or resistance to flow—and may be what the entire universe was made of momentarily some 13 billion years ago.
- With thousands of gold ions colliding per second, RHIC will use less than one millionth of a gram of gold in 20 years.
- RHIC is the world’s only machine capable of colliding high-energy beams of polarized protons to investigate the “missing” spin—an intrinsic property of protons and their quarks and gluons.



RHIC accelerator machinery