

Scientific Achievement

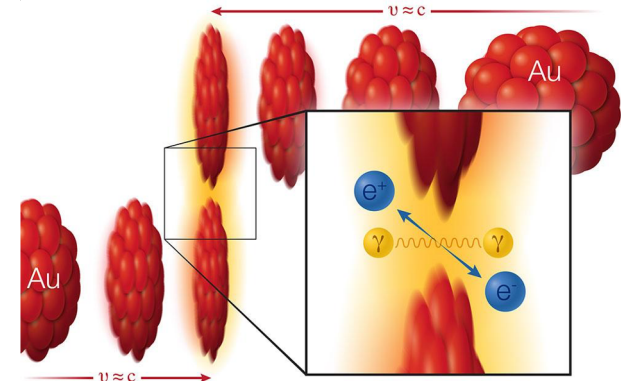
Scientists have produced definitive evidence for a phenomenon predicted more than 80 years ago: the creation of electron/positron pairs from the interaction of two real photons of light. The results are based on a detailed analysis of data from the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory.

Significance and Impact

The finding that pairs of electrons and positrons — particles of matter and antimatter — can be created directly from two interacting real photons had never been observed. The team's new analysis, backed by better statistics and updated theoretical calculations, shows this effect arising from photon interactions associated with close approaches of energetic gold ions produced at RHIC.

Research Details

The results were derived from a detailed analysis of more than 6,000 pairs of electrons and positrons produced in glancing particle collisions. These measurements utilized NERSC resources to establish data corrections extracted by embedding simulated data into real data, a process that STAR runs routinely at NERSC.



Making matter from light: Two gold (Au) ions (red) move in opposite direction at 99.995% of the speed of light (v , for velocity, = approximately c , the speed of light). As the ions pass one another without colliding, two photons (γ) from the electromagnetic cloud surrounding the ions can interact with each other to create a matter-antimatter pair: an electron (e^-) and positron (e^+). Image: Brookhaven National Laboratory

Adam, J. et al ; STAR Collaboration, "Measurement of e^+e^- Momentum and Angular Distributions from Linearly Polarized Photon Collisions"; Physical Review Letters, 127 2021 JUL 27, 10.1103/PhysRevLett.127.052302