

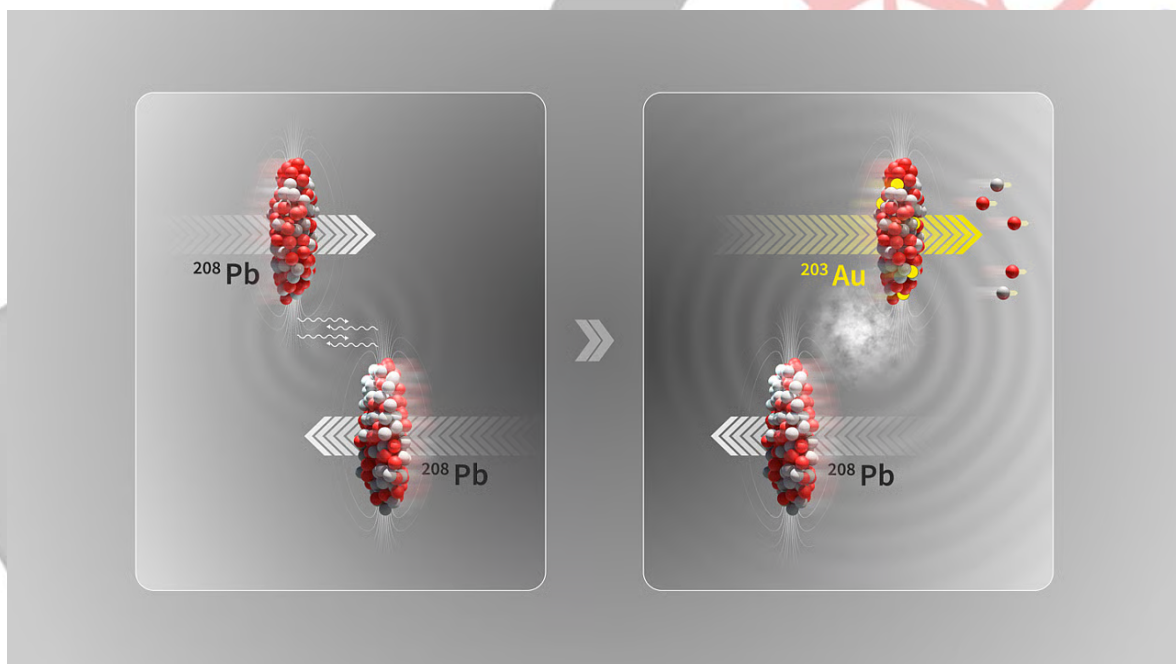


Turning Lead into Gold

[Source: DTE](#)

Scientists at **CERN** briefly **transformed lead (Pb) into gold (Au)** (just a nanosecond) in **tiny amounts** using **high-energy particle collisions** inside the **world's most powerful particle accelerator**, [Large Hadron Collider \(LHC\)](#).

- This was achieved **not by direct collisions** but through **ultra-peripheral “near-miss” interactions** between accelerated **lead nuclei (atomic number 82)**, demonstrating **nuclear transmutation**.
 - **Nuclear transmutation** is the process of **changing one element into another by altering the number of protons or neutrons in an atom's nucleus**.



Ultra-Peripheral Collisions

- At CERN's LHC, **ultra-peripheral collisions** occur when **lead nuclei** pass very close **without direct contact**.
 - Their **electromagnetic fields** interact, emitting **high-energy photons** that trigger **electromagnetic dissociation**- a process where **protons and neutrons are ejected** from the nucleus.
- In such events, **removal of 3 protons from lead (atomic number 82)** results in the formation of **gold (atomic number 79)** and depending on the number of protons lost, elements like **thallium and mercury** were also created.
 - The experiment offers a **striking example of how extreme physics can alter the identity of matter**, showcasing modern **artificial nuclear transmutation** and deepening our understanding of atomic interactions under extreme conditions.

RADIOACTIVE DECAY

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NUCLEAR TRANSMUTATION

RADIOACTIVE DECAY	NUCLEAR TRANSMUTATION
Radioactive decay is the process by which an unstable atomic nucleus releases energy in the form of radiation to reach a more stable state	Nuclear transmutation is the process of changing one element into another by altering the nucleus of the atom
A spontaneous process	Requires an external trigger
Uncontrollable	Has the potential to be controllable
Occurs without the need for external energy input	Requires significant energy input
Releases a relatively small amount of energy	Can release a much larger amount of energy

Read More: [Hadron Collider Run 3](#)