

Antimatter Atoms Apprehended and Trapped: The ALPHA Experiment at CERN

Author

Enago Academy

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Antimatter is the “mirror image” of matter. Every particle that is a constituent of matter has an associated antiparticle. This was first postulated almost 80 years ago. Since then, positrons which are the antiparticles of electrons, anti-protons corresponding to protons and many others, have been created and identified at various experimental facilities around the world.

Whenever antimatter comes into contact with matter, it is annihilated (destroyed) with the release of an amount of energy equivalent to the sum of the mass of the matter and antimatter. Therefore, it is necessary to isolate antimatter from matter so that it can survive long enough to be studied or used.

Creating and then trapping an atom of antimatter, in contrast to individual antiparticles, has been an even greater challenge. This is because most antiparticles have an electric charge and therefore electric and/or magnetic fields can be used to confine them. Anti-atoms are however electrically neutral *i.e.*, they have equal amounts of positive and negative charge. As a result, confining them is much more difficult. They are however characterized by weak magnetic properties which can be used to localize the anti-atoms using specialized configurations of magnetic fields: a so-called *magnetic bottle*.

Researchers at [CERN](#) (the Center for European Nuclear Research) recently accomplished this difficult feat *i.e.*, creating low energy anti-hydrogen atoms and subsequently trapping them, as part of the [ALPHA experiment](#). Thirty-eight anti-hydrogen atoms could be trapped for an average period of two-tenths of a second. The [results were published in Nature](#) a few days ago.

These results have potentially far-reaching impact, both in basic sciences and applications. A couple of examples are given below:

- The overwhelming asymmetry between the amount of matter and antimatter in the universe is an open puzzle *i.e.*, there is far more matter than antimatter, the reasons for which are rooted in the origin of the universe. The current advances could provide some insight into this aspect.
- Anti-atoms and antimatter can be developed to become an enormous energy resource through the controlled annihilation of matter and antimatter, and could dwarf all known sources of energy.

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