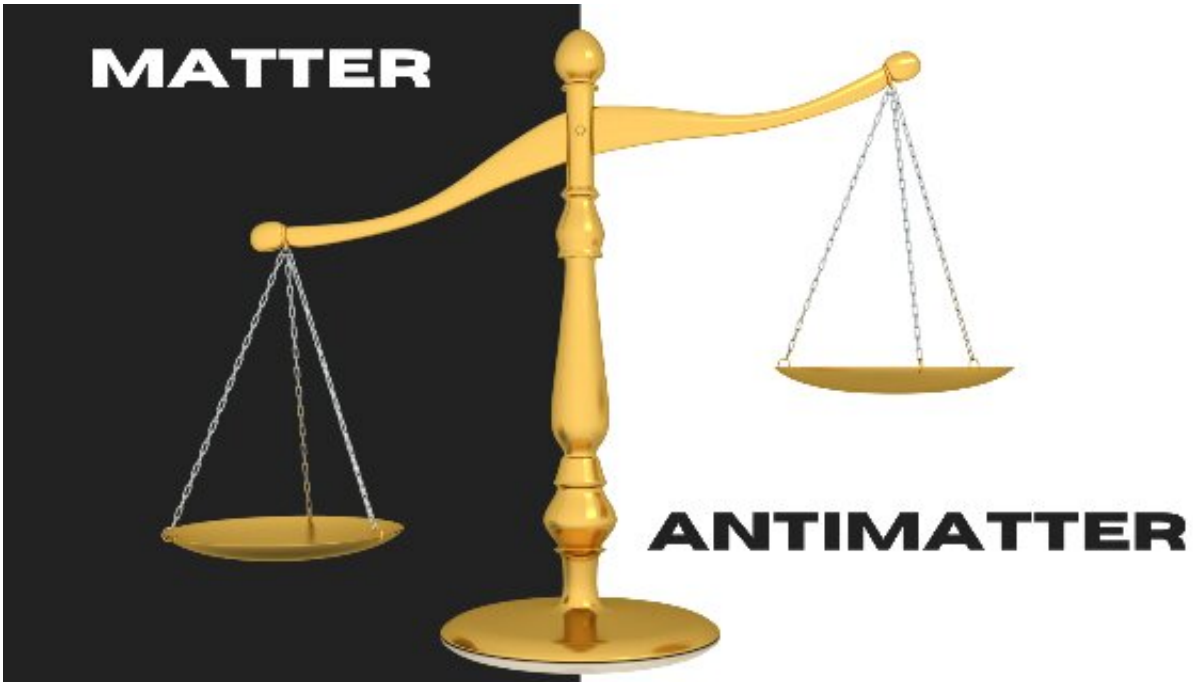


# Revisiting the history of the CPT theorem

May 25 2022, by Robert Lea

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CPT theorem was vital to our understanding of how particles and their antiparticles behave. Credit: Robert Lea

A new review looks at an important and often overlooked aspect of physics that suggested symmetry in the particle zoo and how it could be broken.

At the beginning of the 20th century the development of quantum mechanics and relativity changed the face of physics forever. While

much has been written about this revolution, less is known about the development of the CPT theorem — vital to [quantum field theory](#) and modern physics.

A new paper published in *The European Physical Journal H* authored by Alexander S. Blum and Andres Martinez de Velasco from Max Planck Institute for the History of Science, Berlin, looks at the roots of CPT theorem and its influence over modern physics.

"CPT theorem is the statement that nothing would change — nobody would notice and the predictions of physics would not be altered — if we simultaneously replace particles by antiparticles and vice versa," Blum says. "Replace everything by its mirror image or more exactly: exchange left and right, up and down, and front and back, and reverse the flow of time. We call this simultaneous transformation CPT, where C stands for Charge Conjugation (exchanging particles and antiparticles), P stands for parity (mirroring), and T stands for time reversal."

Blum adds that the CPT theorem only became really important a couple of years after its discovery.

"Originally, [physicists](#) had (tacitly) believed that nothing would change even if we do one of the three transformations mentioned above individually," the researcher says. "In 1957, it was found that we can actually distinguish the world from its [mirror image](#). In particular certain radioactive decays actually distinguish left from right. In time, it was found that, indeed, all three of the transformations individually actually produce noticeable differences."

Blum concludes by explaining that the time is right for a review of CPT [theorem](#) because young researchers are becoming proficient both in historical and philosophical analysis and in the mathematical intricacies

of post-WWII [physics](#).

**More information:** Alexander S. Blum et al, The genesis of the CPT theorem, *The European Physical Journal H* (2022). [DOI: 10.1140/epjh/s13129-022-00037-w](#)

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