

The Asymmetry Between Matter and Anti-Matter

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As far as one can see, our universe is made of matter. No primordial anti-matter is evident. Is this cosmic imbalance a chance occurrence during the birth of the universe or is it an inevitable outcome of a fundamental difference between how matter and anti-matter behave under the charge-parity (CP) transformation mirror?

Nature seems to always obey the CP symmetry mirror with one known exception. The K^0 mesons violate CP symmetry by a tiny amount in their weak decay! The last 37 years have witnessed confusion followed by vigorous experimental and theoretical effort to understand the cause of CP symmetry violation in subatomic particle decays. Standard Model, the reigning theory of fundamental particles and interactions, not only accommodates the observed CP symmetry violation in K^0 decays but also predicts a large matter-antimatter asymmetry in a new system - the weak decay of the massive B^0 mesons.

Two new matter anti-matter colliders in California and Japan have recently started producing B^0 mesons at a record breaking pace with the intent of confronting the Standard Model predictions and searching for new physics beyond it. In this talk I will discuss the nature of this enterprise and the first definitive results from the BaBar and Belle experiments that have provided a clear optic on this mysterious asymmetry between matter and anti-matter.