



Time and Matter 2013, 4-8 March 2013, Venice, Italy

Time-reversal violation and the origin of matter in the Universe

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Abstract

In the plasma of particles of the primordial Universe it is expected that matter and antimatter were present in equal amount. To dynamically develop a matter-antimatter asymmetry starting from such a symmetrical situation, a necessary condition is that CP is violated. In local quantum field theories CP violation is always accompanied by the same amount of time-reversal violation. Interestingly enough, the amount of CP violation (and, hence, of time-reversal violation) present in the Standard Model of particle physics is not enough to give rise to all the matter present in the Universe. Thus, some new physics has to produce a substantial violation of the time-reversal symmetry.