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Laser effect on the branching ratios of Z-boson decay

Experimentalists have long sought a method that allows them to control as they like the branching ratios of an unstable particle decay and direct some decay to follow one specific desired channel without another. The powerful laser could make this dream come true. In this work and within the framework of the standard electroweak model, we investigate theoretically the laser effect on the branching ratios of different Z^0-boson decay modes by calculating analytically the Z^0-boson decay into a pair of fermion-antifermion ($Z^0 \to f\bar{f}$) in the presence of a circularly polarized electromagnetic field. It is found that, at high intensities, the Z^0-boson could only decay invisibly into neutrinos, and its decay into any other pair of charged fermions becomes impossible due to the increase in the effective mass that fermions acquire inside the electromagnetic field. The influence of the laser frequency and intensity on the lifetime is also included in order to confirm the surprising result obtained for the pion lifetime in a previous paper [S. Mouslih \textit{et al.}, Phys. Rev. D \textbf{102}, 073006 (2020)].

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