

On the Dirac-Majorana neutrinos distinction in four-body decays

Content

A novel method to differentiate the effects of Dirac and Majorana (D-M) neutrinos in four-body decays has been discussed in Phys. Rev. D 105 (2022) 113006. It is concluded in that Ref. that the back-to-back kinematic scenario seems to avoid the constraint imposed by the ‘practical Dirac-Majorana confusion theorem’ as one does not need to fully integrate over neutrino and antineutrino momenta. In this paper we propose to analyse radiative leptonic lepton-decays ($\ell \rightarrow \ell' \nu \bar{\nu} \gamma$), as an independent alternative process to study the possible Majorana nature of neutrinos. Our approach demonstrates that, in the back-to-back kinematic configuration (for the $\ell' - \gamma$ and $\nu - \bar{\nu}$ systems, respectively), the distinction between Dirac and Majorana cases disappears when the inaccessible neutrino angle is integrated out. This outcome might appear unexpected considering the motivation outlined in Phys. Rev. D 105 (2022) 113006. We trace back this D-M suppression to the specific angular distribution of radiative leptonic decays and the kinematics of four-body decays. To elucidate these aspects within our approach, we employ consistency tests. All this applies in absence of non-standard interactions, which can enhance generally the sensitivity to the neutrino nature.

Summary

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