

Abstract

We discuss a generalization of the Pauli-Gursey transformation to an arbitrary n number of generations of neutrinos using the Autonne-Takagi transformation $U(2n)$ which defines general canonical transformations and diagonalizes symmetric complex Majorana mass matrices in special cases. We define C, P and CP symmetries at each Pauli frame specified by the generalized Pauli-Gursey transformation. The Majorana neutrinos in the C and P violating seesaw model are then naturally defined by a suitable choice of the Pauli frame, where only Dirac-type fermions appear with well-defined C, P and CP, and thus the C symmetry for Majorana neutrinos agrees with the C symmetry for Dirac-type fermions. This fully symmetric setting corresponds to the idea of Majorana neutrinos as Bogoliubov quasi-particles. In contrast, the conventional direct construction of Majorana neutrinos in the seesaw model, where CP is well-defined but C and P are violated, encounters the mismatch of C symmetry for Majorana neutrinos and C symmetry for chiral fermions; this mismatch is recognized as the appearance of the singlet (trivial) representation of C symmetry for chiral fermions.