

## From Dirac To Neutrino Oscillations

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Quasi-Dirac neutrino oscillations - arXiv The manifestation of the Majorana nature is through rich neutrino oscillation phenomena of pseudo-Dirac neutrinos, including the neutrino ↔ anti-neutrino oscillation due to the lepton-number violating Majorana masses, even inside each generation. The formulae for

### From Dirac To Neutrino Oscillations

The charged current transitions then involve a leptonic mixing matrix (analogous to the Cabibbo-Kobayashi-Maskawa (CKM) quark mixing matrix), which can lead to neutrino oscillations between the light neutrinos. For an ordinary Dirac neutrino the is active and the is sterile. The transition is, where is the weak isospin.

### Weyl Dirac and Majorana neutrinos

of quasi-Dirac neutrinos [5]. Since neutrino oscillations are blind to the Dirac or Majorana nature of neutrinos, one needs other types of experiments, e.g., those searching for neutrinoless double betadecaytodetermineit[6,7].Ingeneral,onecansaythat the Dirac case, consisting of n neutrinos, is a limiting case

### Quasi-Dirac neutrino oscillations at DJNE and IJND

The question of whether a given particle "is" a Dirac or Majorana fermion is more subtle than is sometimes presented. For example, if we just consider the "old" Standard Model with massless neutrinos, then as Srednicki points out (pg. 550), each neutrino species can be described using either a Dirac or a Majorana bispinor field. That's because each neutrino only has two independent spin ...

### Why do people say that neutrinos are either Dirac or ...

participate in solar, atmospheric, and terrestrial neutrino flavor oscillations. The goal of this paper is to discuss an opposite scenario, in which the Dirac-Majorana mass term is dominated by the Dirac masses. Such a scenario, in general, leads to six Majorana neutrino states

### Three Flavor Quasi-Dirac Neutrino Mixing, Oscillations and ...

The manifestation of the Majorana nature is through rich neutrino oscillation phenomena of pseudo-Dirac neutrinos, including the neutrino ↔ anti-neutrino oscillation due to the lepton-number violating Majorana masses, even inside each generation. The formulae for the various oscillations of pseudo-Dirac neutrinos are obtained.

### Pseudo-Dirac Neutrinos

one possible Dirac CP-violating phase δ and two additional phases if neutrinos are Majorana par-ticles [10]. Note that the standard parametrization presented in [10] is adopted in this presentation. Neutrino oscillations are driven by the two mass squared differences, Δm<sup>2</sup><sub>21</sub> = m<sup>2</sup><sub>2</sub> − m<sup>2</sup><sub>1</sub>; Δm<sup>2</sup><sub>31</sub> = m<sup>2</sup><sub>3</sub> − m<sup>2</sup><sub>1</sub>. The two cases Δm<sup>2</sup><sub>31</sub> > 0 and Δm<sup>2</sup>

### Theoretical Status of Neutrino Oscillation Physics

fect is the appearance of the neutrino oscillation term E ~ m<sup>2</sup> v + 6m<sup>2</sup> v 2p, (38) in the ultra high-momentum limit. This implies that the observed neutrino oscillations can be due to the flavor mixing by the rest mass (Majorana or Dirac) and/or by the medium-induced "mass-squared" which does not in-volve chirality-flip or lepton ...

### arXiv:2012.09474v1 [hep-ph] 17 Dec 2020

Absolute neutrino mass scale Beta decay endpoint studies and cosmological observations probe the absolute neutrino mass, inaccessible to oscillations. For example, the Katrin experiment has set an upper limit of 1.1 eV (at 90% C.L.) [20], which holds irrespective of whether neutrinos are Dirac or Majorana.

### Neutrino oscillations and flavor theories

Neutrino oscillation is a quantum mechanical phenomenon in which a neutrino created with a specific lepton family number ("lepton flavor": electron, muon, or tau) can later be measured to have a different lepton family number. The probability of measuring a particular flavor for a neutrino varies between three known states, as it propagates through space.

### Neutrino oscillation - Wikipedia

The propagation of Dirac neutrinos in a massive medium is governed by the Dirac equation modified with an effective Hamiltonian that de- pends on the number density of surrounding matter fields. At the same time, quantum nonlinearities may contribute to neutrino oscillations by further mod- ifying the Dirac equation.

### Nonlinear Dirac Neutrino Oscillations - INSPIRE

Given m<sub>0</sub> [u] for the Dirac neutrino mass matrix MD, the mass scale of three heavy Majorana neutrinos turns out to be M0 [2u 2 / m3 [ (4.9 – 7.6) × 10 14 GeV, which is quite close to the scale of grand unified theories Λ GUT – 10 16 GeV. View chapter Purchase book Properties of tau lepton

### Neutrino Masses - an overview | ScienceDirect Topics

We introduce two Dirac neutrinos and two inert doublets. We demonstrate that the model has a large allowed region that satisfies the constraints from neutrino oscillation data, lepton flavor violations, direct/indirect detection of dark matter and dark matter relic density.

### Dirac dark matter in a radiative neutrino model ...

Sterile neutrinos (or inert neutrinos) are hypothetical particles (neutral leptons – neutrinos) that interact only via gravity and do not interact via any of the fundamental interactions of the Standard Model.The term sterile neutrino is used to distinguish them from the known active neutrinos in the Standard Model, which carry an isospin charge of ± + 1 / 2 under the weak interaction.

### Sterile neutrino - Wikipedia

If the two are different, they are called Dirac particles (after Paul Dirac), while if the same, they are called Majorana particles (after Ettore Majorana). If neutrinos are Majorana particles, this opens up all sorts of new kinds of physics. A kind of radioactive decay called neutrinoless double beta decay is possible.

### Neutrinos: Majorana or Dirac? | News

Data on the Dirac phase will be obtained in the long baseline neutrino oscillation experiments T2K, NO A, and other (see, e.g., ). Testing the possibility of Dirac CP violation in the lepton sector is one of the major goals of the next generation of neutrino oscillation experiments (see, e.g., [35, 78]).

### The Nature of Massive Neutrinos

that the neutrino released from one beta decay may be absorbed into a nucleon and induce a second beta de-cay. Typically this reaction would require the nucleon to absorb an antineutrino, and therefore is not possible if neutrinos are Dirac particles, but if neutrinos are Majo-rana particles, there should be a small chance that this will occur.

### Neutrino Mass Problem: Masses and Oscillations

The Dirac neutrino and antineutrino have the same mass and differ by the lepton number (, ). ... The discovery of neutrino oscillations was a great triumph for Bruno Pontecorvo who came to the idea of neutrino oscillations at a time when the common opinion favored massless neutrinos.

### Bruno Pontecorvo and Neutrino Oscillations

Dirac neutrino or antineutrino states in the semiweak interactions while being described as pairs of Majorana neutrino states in the long-baseline neutrino oscillations. No consistent theory of such a fundamental Dirac-Majorana neutrino duality is known as yet, also [5].