

Frontiers in Basic Physics and Applications

Kamal Jyoti Nath
Debika Kangsha Banik
Nayan Mani Nath
Sebika Kangsha Banik

This Edited Book is a collection of research papers/articles on the theme of “**Frontiers in Basic Physics and Applications**”. The book is intended for students, research scholars, academicians and planners who are interested and engaged in the field of Physics and its various applications.

Editors: **Kamal Jyoti Nath**
Debika Kangsha Banik
Nayan Mani Nath
Sebika Kangsha Banik

Published by:

Knowledge Publications

Publishing your knowledge

Contact:

Shivam Books, Book Bazar, M. N. Road,
Panbazar, Guwahati, Assam- 781001

&

D K Enterprise, Khairabari, Barpeta Road,
PO- Barpeta Road, Dist- Barpeta, Assam
Pin- 781315

Contact No. 700214112/7002935051/9859572724

E-mail: publishingyourknowledge@gmail.com

ISBN: 978-81-933014-8-7

First Edition: September, 2020

Price: ₹ 1195.00

Disclaimer

The opinions expressed in the papers/articles published in this edited book are opinions of the authors. The editor or publisher of this edited book titled “**Frontiers in Basic Physics and Applications**” is in no way responsible for the opinions deduced by them. In case of plagiarism also responsibility lies solely with the author(s).

Contents

1. Theoretical Investigation of Fusion Excitation Function and the Barrier Distribution for reaction ${}^8\text{B}+{}^{28}\text{Si}$, ${}^{58}\text{Ni}$ /
Amar Das, Kishor Deka, Nabendu K. Deb and Kushal Kalita 1
2. Design and simulation studies of CIGS solar cells /
B. Barman and P. K. Kalita 7
3. Study of plasma sheath in presence of oblique magnetic field and hot electrons / **Gunjan Sharma** 15
4. Study of Plasma Sheath in the presence of magnetic field parallel to the surface / **Kishor Deka and Amar Das** 20
5. Analysis of magnetized plasma sheath in presence of negative ions / **Rupali Paul** 26
6. Widths of the rapidity distributions of charged kaons produced in Pb+Pb collisions at Super Proton Synchrotron (SPS) energies/
Nur Hussain 31
7. Gravity Wave: Observations, Modeling and Atmospheric dynamics / **Jinee Gogoi and Kalyan Bhuyan** 37
8. Protein Mediated Synthesis of CuNCs as pb^{2+} Sensor /
Ashim Chandra Bhowal 44
9. Ion flow velocity of plasma jet inside an inertial electrostatic confinement fusion device / **Darpan Bhattacharjee** 51
10. Design and simulation studies of CdTe and CIGS based solar cells using SCAPS-1D /
K. C. Handique, M. P. Borah, N. M. Nath and P.K. Kalita 58
11. Sterile Neutrino: A Fourth Flavor of Neutrino /
Nayana Gautam and Mrinal Kumar Das 65
12. The stability and electronic properties of pure and P-doped InN nanosheet: A DFT study /
Amarjyoti Das and R. K. Yadav 70
13. Scotogenic Model and its Implication in Neutrino Physics and Related Cosmology: a Brief Overview /
Lavina Sarma, Bichitra Bijay Boruah and Mrinal Kumar Das 77
14. Particle Creation in Cosmology /
Chayanika Chetia and Kalyan Bhuyan 82
15. Interaction between Dark Matter and Dark Energy using DBI model / **Ronit Karmakar** 90

16.	Speed Matters: A Brief Account on Particle Accelerators Used in Medical Field / Rangaraj Bhattacharjee and Biswajit Nath	95
17.	Study of neutrino parameters considering Type I and Type II seesaw models / Rupam Kalita	101
18.	Concepts of Static and Expanding Universe / Bishwajit Boruah	108
19.	Characterization of RF sputtered Sn substituted Mg_2TiO_4 thin film for integrated electronic applications / Pallabi Gogoi and D. Pamu	112
20.	Structural and Optical properties of lightly Fe doped ZnS nanocrystals synthesized at room temperature / Kuldeep Deka	118
21.	Images with unheard sound: "The Physics of Ultrasonography" – A Review Article / Biswajit Nath, Rangaraj Bhattacharjee and Ananya Bhattacharjee	126
✓22.	Neutrino Mass Matrix with one-zero in Type-I+II seesaw model with A_4 Symmetry / Surender Verma* and Monal Kashav	131
23.	Optical Applications of Dyes / Arindam Boruah	137
24.	Dust ion acoustic solitons in a magnetized quantum plasma / S. kalita and O. P. Sah	144
25.	Estimation of lattice size and strain of mixed phase Lead Oxide using W.H technique / Barnali Pathak, Jyoti Prasad Roy Choudhury, Pradip Kr Kalita and Nagangom Aomoa	150
26.	Optical and structural properties of Cu doped ZnS/PVA thin films / Gitashri Arandhara and P. K. Saikia	155

Neutrino Mass Matrix with one-zero in Type-I+II seesaw model with A_4 Symmetry

Surender Verma* and Monal Kashav

Department of Physics and Astronomical Science, Central
University of Himachal Pradesh, Dharamshala,
Himachal Pradesh-176215, India

*Email: s_7verma@yahoo.co.in

Abstract

The phenomenological zeros in the neutrino mass matrix increase the predictability of the model by decreasing the number of free parameters in the neutrino mass matrix. In this work, we have investigated the texture one-zero in neutrino mass matrix using the latest data of oscillation parameters except atmospheric mixing angle. We analyse all possible one-zero texture mass matrices and obtain predictions for CP violation, θ_{23} -octant and neutrino mass hierarchies. The CP symmetry is necessarily violated in mass matrices M_ν , M_2 and M_3 . θ_{23} is below 45° at 2.5σ for M_4 type neutrino mass matrix with normal hierarchical neutrino masses. An A_4 model is, also, derived wherein such textures can be realized in nature.

Keywords: Neutrino mass matrix, mixing angle, neutrino mass, texture zeros.

1. Introduction

In the flavor basis, the neutrino mass matrix M_ν can be diagonalised or reconstructed in terms of the three masses (m_1, m_2, m_3) and flavor mixing matrix U also known as Pontecorvo-Maki-Nakagawa-Sakata (PMNS) matrix. It is a unitary matrix which contains information about the mismatch of neutrino quantum states (flavor and mass eigenstates). This 3×3 matrix U is in general parameterized in term of three mixing angle ($\theta_{12}, \theta_{23}, \theta_{13}$) and one Dirac phase (δ). If neutrinos are Majorana particles two additional CP-phases (α, β) are required to describe the neutrino mixing matrix, completely.