HIROSHIMA UNIVERSITY

広島大学 極限宇宙研究拠点
CORE-U
Core of Research for the Energetic Universe
HIROSHIMA UNIVERSITY

第104回2025年度第3回
広島大学極限宇宙研究拠点セミナー
Hiroshima University CORE-U Seminar

Speaker: Prof. Massimo Blasone

（Dipartimento di Fisica, Università di Salerno
& INFN Sezione di Napoli.）

Title: Quantum field theory of flavor and chiral oscillations

Date： 25th.July.2025 (Fri) (14:35-16:05)
2025年7月25日(金）(14:35-16:05)

Place: 広島大学理学部E102教室 （ハイブリッド）

Room E102, Faculty of Science, Hiroshima University

Abstract: See the back side of this poster

Teams Link:
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Organizers : Yorito Yamaguchi, Tsunefumi Mizuno ,Takuya Morozumi

Abstract

I will review recent work on flavor and chiral oscillations in the context of quantum field theory, considering both perturbative and non-perturbative approaches.
The quantization of mixed fields (neutrinos, in particular) has revealed a surprisingly rich mathematical structure, due to the inequivalence of the representations for fields with definite mass and those with definite flavor. I will argue for the physical relevance of exact flavor neutrino states, which are associated with a condensate of particle–antiparticle pairs in the (flavor) vacuum, induced by a Bogoliubov transformation. Phenomenological consequences of this result will be discussed.
Based on the analogy between oscillating neutrinos and unstable particles, I will show that finite-time perturbation theory correctly reproduces the exact oscillation formula obtained through the non-perturbative flavor Fock space approach.
Similar results have been found in the case of chiral oscillations: the states generated by charged-current weak interactions with definite chirality are consistently defined via a Bogoliubov transformation, which diagonalizes the relevant operators - i.e., the chiral charges. In this case as well, a perturbative treatment confirms the results obtained through the non-perturbative approach.

Finally, I will briefly report on recent findings regarding the quantum correlations associated with neutrino oscillations, which suggest their potential use as a tool for quantum information tasks.