5th Colombian Meeting on Flavor Physics

Report of Contributions

https://indico.global/e/16315

Contribution ID: **3** Type: **not specified**

Gauge Symmetry in the Hamilton-Jacobi Formulation

This study determined the constraint structure of the gauge-symmetric Proca field using the Hamilton-Jacobi approach. We extracted the complete set of Hamiltonians from Frobenius' integrability conditions, along with the characteristic equations. Functioning as canonical transformation generators, these Hamiltonians directly correspond to the generators of the Lagrangian gauge transformations. The system was closed by applying appropriate gauge conditions and explicitly computing the generalized brackets

Author: RAMOS, German

Co-author: Mr PORTILLO, Jose (Universidad de Nariño)

Presenter: RAMOS, German

Contribution ID: **4** Type: **not specified**

Families and Irreducible Anomaly-Free Sets for 3–3–3–1 Gauge Theories

We present a model-agnostic scheme to assemble \textbf{quark–lepton families} within flipped trinification, $SU(3)_C \times SU(3)_L \times SU(3)_R \times U(1)_X$, allowing for arbitrary charge embeddings. The core of our construction is the identification and taxonomy of \textbf{Irreducible Anomaly-Free Sets (IAFS)}: minimal fermion multiplet combinations that, on their own, cancel all gauge and mixed anomalies—$[SU(3)_{L,R}]^3$, $[SU(3)_{L,R}]^2U(1)_X$, $[SU(3)_C]^2U(1)_X$, $U(1)_X^3$, and grav$^2U(1)_X$. We show that Standard-Model families can be realized as unions of only a few IAFS, deriving general relations between color and family replication and recovering the familiar 331-like non-universality as a limiting case. For each IAFS we supply charge assignments consistent with the electroweak sector, delineate the scalar content required for the staged breaking $SU(3)_L \times SU(3)_R \times U(1)_X \to SU(2)_L \times U(1)_Y$, and exhibit renormalizable Yukawa structures that yield realistic quark and lepton masses—including right-handed neutrinos—while keeping exotic states under control. The classification feeds directly into phenomenology, implying characteristic patterns for extra neutral currents (Z'/Z''), exotic quark/lepton charges, residual discrete symmetries, and flavor textures. Altogether, we provide a modular set of "building blocks" to engineer flipped-trinification models from \textbf{quark–lepton families} and their \textbf{irreducible anomaly-free} combinations, and we delineate which embeddings remain compatible with current collider and flavor constraints.

Author: Prof. GIRALDO USUGA, Yithsbey (Universidad de Nariño)

Co-authors: Prof. ROJAS, Eduardo (Universidad de Nariño.); Dr BENAVIDES, Richard (Instituto Tecnológico Metropolitano, ITM)

Presenter: Prof. GIRALDO USUGA, Yithsbey (Universidad de Nariño)

Contribution ID: **5** Type: **not specified**

Probing flipped trinification at colliders

We explore the recently proposed gauge symmetry
\(SU(3)_C \otimes SU(3)_L \otimes SU(3)_R \otimes U(1)_X \),
which naturally embeds both the Left-Right symmetric model and the 3-3-1 model as subgroups. Within this unified framework, we propose four families of leptons and quarks. A detailed analysis of their contributions to gauge anomaly cancellation is carried out for a general value of the parameter β.

We also report LHC bounds on the Z' mass for the particular case $\beta = -1/\sqrt{3}$, considering all possible combinations of lepton and quark families. These limits exhibit a strong dependence on the mixing parameter θ, which enters the couplings of Standard Model fermions to the Z' boson.

Authors: Prof. ROJAS, Eduardo (Universidad de Nariño.); Dr BENAVIDES, Richard (Instituto Tecnológico Metropolitano, ITM); Prof. GIRALDO USUGA, Yithsbey (Universidad de Nariño)

Presenter: Prof. ROJAS, Eduardo (Universidad de Nariño.)

Contribution ID: **9** Type: **not specified**

Discrete Flavor Symmetries in Multi-Higgs Models

In this talk we review briefly the Standard Model, then we explain the role of symmetries in extensions of the Standard Model, with particular emphasis on multi-Higgs models. We also discuss some aspects of the interrelation between astroparticle physics and physics Beyond the Standard Model, like the matter-antimatter asymmetry and dark matter.

Author: MONDRAGON, Myriam

Presenter: MONDRAGON, Myriam

Session Classification: Eduardo Rojas

Contribution ID: **10** Type: **not specified**

Axions, neutrinos, and Higgs-like resonances, a fuzzy combination

Recent results from several experimental collaborations have reported deviations from the Standard Model predictions in di-photon final states, suggesting the presence of intermediate scalar resonances above the electroweak scale. The wide variety of such anomalies can be naturally accommodated within extensions of the Standard Model that feature an enlarged scalar sector. In particular, multi-Higgs doublet structures are well motivated in Flavored Axion Models (FAMs) proposed to explain the texture zeros of the quark mass matrices while simultaneously addressing the strong CP problem. In this work, we analyze a specific realization of a FAM and determine the scalar mass scale at which new resonances are expected to appear, based on the most theoretically motivated ranges for the vacuum expectation values and couplings of the scalar potential. Our model is capable of generating scalar resonances at the electroweak scale while simultaneously accommodating a light axion. In our framework, the scalar field that breaks the Peccei–Quinn symmetry also accounts for the masses of the right-handed neutrinos, revealing a natural interplay between the two sectors. Furthermore, we examine the phenomenological implications of the model, reporting flavor-changing neutral current constraints derived from semileptonic decays, together with the current experimental bounds on the axion–photon coupling from axion searches

Authors: Prof. ROJAS, Eduardo (Universidad de Nariño.); Prof. GIRALDO USUGA, Yithsbey (Universidad de Nariño); SALAZAR, juan

Presenter: Prof. ROJAS, Eduardo (Universidad de Nariño.)

Session Classification: Carlos Vera