First ECFA WORKSHOP.

Contribution ID: **56** Type: **Parallel session talk**

Probing new U(1) gauge symmetries via exotic $Z \to Z'\gamma$ decays

Thursday 6 October 2022 17:05 (15 minutes)

New U(1) gauge theories involving Standard Model (SM) fermions typically require additional electroweak fermions for anomaly cancellation. We study the non-decoupling properties of these new fermions, called anomalons, in the Z–Z′–γ vertex function, reviewing the connection between the full model and the effective Wess-Zumino operator. We calculate the exotic $Z \to Z'\gamma$ decay width in U(1)B–L and U(1)B models, where B and L denote the SM baryon and lepton number symmetries. For U(1)B–L gauge symmetry, each generation of SM fermions is anomaly free and the exotic $Z \to Z'BL\gamma$ decay width is entirely induced by intragenerational mass splittings. In contrast, for U(1)B gauge symmetry, the existence of two distinct sources of chiral symmetry breaking enables a heavy, anomaly-free set of fermions to have an irreducible contribution to the $Z \to Z'B\gamma$ decay width. We show that the current LEP limits on the exotic $Z \to Z'B\gamma$ decay are weaker than previously estimated, and low-mass Z′B dijet resonance searches are currently more constraining. We present a summary of the current collider bounds on U(1)B and a projection for a TeraZ factory on the $Z \to Z'B\gamma$ exotic decay, and emphasize how the $Z \to Z'\gamma$ decay is emblematic of new anomalous U(1) gauge symmetries.

Primary author: YU, Felix (JGU Mainz)

Presenter: YU, Felix (JGU Mainz)

Session Classification: WG 1 - Searches

Track Classification: WG1-SRCH - Physics Potential: Feebly interacting particles, direct low mass searches