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Muon (g – 2) and Thermal WIMP DM in U(1)Lμ–Lτ Models

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U(1)Lμ–Lτ ≡ U(1)X model is anomaly free within the Standard Model (SM) fermion content, and can accommodate the muon (g–2) data for MZ′ ~ O(10–100) MeV and gX ~ (4–8)×10–4. WIMP type thermal dark matter (DM) can be also introduced for MZ′ ~ 2MDM, if DM pair annihilations into the SM particles occur only through the s-channel Z′ exchange. In this work, we show that this tight correlation between MZ′ and MDM can be completely evaded both for scalar and fermionic DM, if we include the contributions from dark Higgs boson (H1). Dark Higgs boson plays a crucial role in DM phenomenology, not only for generation of dark photon mass, but also opening new channels for DM pair annihilations into the final states involving dark Higgs boson, such as dark Higgs pair as well as Z′Z′ through dark Higgs exchange in the s-channel, and co-annihilation into Z′H1 in case of inelastic DM. Thus dark Higgs boson will dissect the strong correlation MZ′ ~ 2MDM, and much wider mass range is allowed for U(1)X-charged complex scalar and Dirac fermion DM, still explaining the muon (g – 2). We consider both generic U(1)X breaking as well as U(1)X ⟶ Z2 (and also into Z3 only for scalar DM case).

Authors: Mr KIM, Jongkuk; KO, Pyungwon (KIAS); BAEK, Seungwon (Korea Univ.)

Presenter: Mr KIM, Jongkuk

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