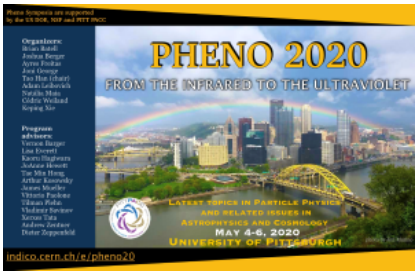

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A Light Scalar Explanation of Muon g–2 and the KOTO Anomaly

Monday 4 May 2020 16:30 (15 minutes)

The KOTO experiment has recently performed a search for neutral Kaons decaying into neutral pions and a pair of neutrinos. Three events were observed in the KOTO signal region, with an expected background of about 0.05. Since no clear signal of systematic errors have been found, the excess of events in the decay $K_L \to \pi^0 \nu\bar{\nu}$ is quite intriguing. One possibility to explain this anomaly would be the presence of a scalar ϕ with mass of the order of the pion mass and inducing decays $K_L \to \pi^0 \phi$ which mimic the observed signal. A scalar with mass of the order of the pion mass and a coupling to muons of the order of the Standard Model Higgs coupling could also explain the muon anomalous magnetic moment anomaly $(g-2)_\mu$. We built on these facts to show that a light singlet scalar with couplings to the leptons and quarks as the ones induced by mixing with Higgs states in two Higgs doublet models may lead to an explanation of both anomalies. More specifically, we show that this is the case in the so-called type-X models in which leptons and quarks couple to two different Higgs doublets, and for scalar masses that are in the range between 40 and 70 MeV. Due to the relatively large coupling to leptons required to fit $(g-2)_\mu$, the scalar lifetime accidentally falls into the sub-nanosecond range which is essential to evade the severe proton beam dump experiments and astrophysical constraints, though it becomes sensitive to constraints from electron beam dump experiments. The additional phenomenological properties of this model are discussed.

Summary

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