Séminaire IJCLab

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Neutron lifetime anomaly and consistent origin of dark matter and baryon asymmetry

Originated from Lee and Yang's seminal work on parity violation, a rather exact mirror matter model is proposed using spontaneous mirror symmetry breaking, which results in oscillations of neutral particles [1-5]. As it turns out, neutron-mirror neutron (n-n') oscillations become one of the best messengers between the ordinary and the mirror worlds. The new n-n' model resolves the neutron lifetime anomaly, i.e., the 1% difference between measurements from "Beam" and "Bottle" experiments [1]. The picture of how the mirror-to-ordinary matter density ratio is evolved in the early universe into today's observed dark-to-baryon matter density ratio (~5.4) is gracefully demonstrated [1].

More intriguingly, a natural extension of the new model applying kaon oscillations in the early universe shows a promising solution to the long-standing baryon asymmetry problem with new insights for the QCD phase transition and B-violation topological processes [3]. A consistent picture for the origin of both baryon asymmetry and dark matter can then be depicted with kaon and neutron oscillations under the new model. Based on this model, a new theory - extended Standard Model with Mirror Matter (SM^3) [6] is developed for an elegant solution to dark energy and a foundation for addressing consistently and quantitatively many other celebrated puzzles: evolution of stars [2], ultrahigh energy cosmic rays [4], unitarity of the CKM matrix [5], etc. Last but not least, various laboratory measurements using current technology are proposed to test the new theory [5].

[1] https://arxiv.org/abs/1902.01837 [Phys. Lett. B 797, 134921 (2019)]

[2] https://arxiv.org/abs/1902.03685

[3] https://arxiv.org/abs/1904.03835 [Phys. Rev. D 100, 063537 (2019)]

[4] https://arxiv.org/abs/1903.07474

[5] https://arxiv.org/abs/1906.10262

[6] https://arxiv.org/abs/1908.11838

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