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New results on the neutron to hidden neutron oscillations hypothesis

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Neutron to hidden neutron oscillation (n – n') experiments
are one of the several probes for testing the existence of hidden sector worlds [1, 2]. Although hidden states of matter were originally proposed to restore, on a general picture, the breaking of P and CP symmetries [4], currently they also correspond to candidates for dark matter [3]. In this work, we present a new experimental technique with ultra-cold neutrons (UCN) to test n – n' in the range of intermediate mass splitting. The experiment, which took place at the ILL's PF2 UCN source in 2020, used magnetic fields in the range [50 – 1130] μT to suppress the degeneracy-lifting energy difference. The preliminary analysis indicated no presence of n – n' signals, but lead to a new exclusion region of the parameter space, written as τ_nn 0 > 1 s for |δm| ∈ [2 – 69] × 10 −12 eV (95% C.L.). [1] C. Abel et al. "A search for neutron to mirror-neutron oscillations using the nEDM apparatus at PSI". In: Physics Letters B 812 (2021), p. 135993. doi: https://doi.org/10.1016/j. physletb.2020.135993. [2] H. Almazán et al. "Searching for Hidden Neutrons with a Reactor Neutrino Experiment: Constraints from the STEREO Experiment". In: Phys. Rev. Lett. 128 (6 Feb. 2022), p. 061801. doi: 10.1103/PhysRevLett.128.061801. [3] R. Foot. "Mirror dark matter: Cosmology, galaxy structure and direct detection". In: In-ternational Journal of Modern Physics A 29.11n12 (2014), p. 1430013. doi: 10 . 1142 / S0217751X14300130. [4] T. D. Lee and C. N. Yang. "Question of Parity Conservation in Weak Interactions". In: Phys. Rev. 104 (1 Oct. 1956), pp. 254–258. doi: 10.1103/PhysRev.104.254.

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