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Computational Analysis of an Experimental Approach to Search for Free Neutron-Antineutron Oscillations Based on Coherent Neutron and Antineutron Multilayer Mirror Reflection[1] KYLIE DICKERSON, Indiana Univ - Bloomington — An observation of neutron-antineutron oscillations (n – $\bar{n}$), which violate both B and B – L conservation, would constitute a scientific discovery of fundamental importance to physics and cosmology. A stringent upper bound on its transition rate would make an important contribution to our understanding of the baryon asymmetry of the Universe by eliminating the postsphaleron baryogenesis scenario in the light quark sector. We present a quantitative analysis of the theoretical performance of certain types of $n/\bar{n}$ multilayer mirrors. Selecting materials with a large contrast in the neutron scattering length density and a continuous distribution of thicknesses can minimize, for sufficiently small transverse momenta of $n/\bar{n}$, the relative phase shift of the n and $\bar{n}$ components upon reflection [1], allowing for sufficient coherence to benefit from the greater phase space acceptance a multilayer mirror can provide. We make use of a recent theoretical analysis [2] to estimate the antineutron optical potentials. [1] V. V. Nesvizhevsky et al., Phys. Rev. Lett. 122, 221802 (2019). [2] K. V. Protasov et al., Phys. Rev. D 102, 075025 (2020).

[1]NSF PHY-19137891

Kylie Dickerson
Indiana Univ - Bloomington

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