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A Next-Generation Neutron-Antineutron Oscillations Experiment at Fermilab

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Neutron-antineutron oscillations provide an extremely sensitive probe for new interactions that change baryon number by 2 units. The discovery of oscillations would have broad impact in particle physics and cosmology: it would imply all matter containing neutrons is ultimately unstable and could inform our understanding of the matter-antimatter asymmetry in the universe. A next-generation neutron-antineutron oscillations experiment, NNbarX, is being planned as a part of Project X at Fermilab. This experiment would utilize a cold-neutron source situated at a 1 MW spallation target dedicated to particle physics experiments. When coupled to an optimized, elliptical neutron reflector in a horizontal geometry, a sensitivity improvement of roughly two orders of magnitude (for one year of running) is expected over the previous limit for the free neutron. We present an overview of the conceptual approach, the expected sensitivity, and ongoing research and development on aspects of the experimental layout, neutronics design, and components of the annihilation detector.

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