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Probes for Fundamental Symmetries and Dark Gauge Bosons via η Decays

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Long lived η meson, with quantum numbers of the vacuum, provides a unique, flavor-conserving laboratory to test fundamental symmetries and to search for new physics beyond the Standard Model. A new experiment to measure the η radiative decay width to a 3% accuracy via the Primakoff effect (the PrimEx-eta experiment) is currently under preparation at Jefferson Lab (JLab). The anticipated result will offer an accurate determination of the light quark-mass ratio and the η - η' mixing angle. In addition, a recently approved JLab Eta Factory (JEF) experiment is to measure various η/η' decays, producing the cleanest data in the world for the rare neutral decay modes. JEF will have sufficient precision to explore the role of scalar meson dynamics in chiral perturbation theory for the first time, to search for sub-GeV dark gauge bosons (a leptophobic vector B' and an electrophobic scalar ϕ') by improving the existing bounds by up to two orders of magnitude that is complementary to the ongoing worldwide efforts on invisible decays or decays involving leptons, and to provide the best direct detection for C-violating, P-conserving new forces. The status of these experiments and their physics impacts will be presented.

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