JLab Eta Factory

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The system of η and η′ offers a flavor-conserving laboratory to test the low-energy QCD and to search for new physics Beyond the Standard Model. The symmetry properties of QCD at low-energy, such as the chiral symmetry or the axial anomalies, are manifested in the decays of η and η′. Thus, a study of η/η′ will yield light on our understanding of the origin and the dynamics of QCD confinement. In addition, the η/η′ meson has quantum numbers of vacuum (except parity) with its strong and electromagnetic decays being either anomalous or forbidden to the lowest order due to symmetries or angular momentum conservation. This enhances the relative importance of higher order contributions, making rare η/η′ decays a sensitive hadronic probe for weakly-coupled new forces. Searching for sub-GeV dark gauge boson candidates and the C-violating, P-conserving interactions in various η/η′ decays will extend our knowledge of the dark sector and explore new sources of CP violation that are needed to explain the observed matter and anti-matter asymmetry in the universe. The JLab Eta Factory experiment is aimed at simultaneous measurements of η and η′ decays, with emphasis on rare neutral mode. This experiment will start in spring 2025 using the GlueX apparatus with a newly upgraded Forward calorimeter. The status and the new experimental opportunities for the η/η′ physics will be presented.

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