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Tests of fundamental symmetries via π0, η and η′

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The decays of the light meson π0, η and η′ offer a flavor-conserving laboratory to assess the low-energy QCD and to search for new physics Beyond the Standard Model. The QCD symmetries and symmetry breakings at low-energy, such as the chiral symmetry or the axial anomalies, are manifested in their most unambiguous form in the sector of light pseudoscalar mesons. An experimental study of various decays 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 the 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 to explain the observed matter and anti-matter asymmetry in the universe. The status of experimental activities at JLab and the future new opportunities will be discussed.

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