Anomalous decays of η' and η into four pions

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We report about the calculation of the branching ratios of the yet unmeasured η' decays into four pions, based on a combination of chiral perturbation theory and vector-meson dominance [1]. The decays $\eta' \to 2(\pi^+\pi^-)$ and $\eta' \to \pi^+\pi^-2\pi^0$ are P-wave dominated and can largely be thought to proceed via two ρ resonances. Branching fractions of $(1.0\pm0.3)\times10^{-4}$ and $(2.4\pm0.7)\times10^{-4}$, respectively, are calculated which are not much lower than the current experimental upper limits. The decays $\eta' \to 4\pi^0$ and $\eta \to 4\pi^0$, in contrast, are D-wave driven [2] as long as conservation of CP symmetry is assumed, and are significantly further suppressed. Any experimental evidence for the decay $\eta \to 4\pi^0$ could almost certainly be interpreted as a signal of CP violation. The CP-violating amplitudes for $\eta' \to 4\pi^0$ and $\eta \to 4\pi^0$, induced by the QCD θ -term, are calculated in addition.

[1] F.-K. Guo, B. Kubis, and A. Wirzba, Phys. Rev. D 85, 014014 (2012), arXiv:1111.5949

[2] A. Kupść and A. Wirzba, J. Phys. Conf. Ser. 335, 012017 (2011), arXiv:1103.3860

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