

Fundamental tests of P and CP symmetries using octet baryons at the J/ψ threshold

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We systematically investigate tests of the parity and the combined parity and charge-conjugate symmetries from differential angular distributions of decaying into the lowest-lying baryon pairs at BESIII and the next-generation super tau-charm facilities (STCFs). Large corrections from and exchange induced parity-violating effects are found for decays with large logarithms resummed up to . The parity-violating asymmetries on the production and the decay sides of are both estimated to be of , thus barely observable with the 10 billion events currently collected at BESIII. Nevertheless, these asymmetries utilizing the current BESIII data already permit a measurement of the weak mixing angle with an absolute uncertainty , corresponding to the first determination of at the threshold. In the future, STCFs are estimated to improve this bound by a factor of to within one year based on luminosity rescaling. We also obtain the 95% confidence level upper bounds on the electric dipole moments of the octet baryons, which are of for BESIII and for STCFs. These bounds are improved by 2 to 3 orders of magnitude in comparison with the only existing one on from Fermilab. The method discussed in this work also paves a way for a first and direct measurement of the and electric dipole moments.

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