

# Polarised and entangled hyperon-antihyperon pairs in BESIII

Friday, July 31, 2020 9:10 AM (20 minutes)

Structure, interactions and decays of hyperons can be studied at an electron-positron collider in annihilations to a hyperon-antihyperon pair. The well-defined and simple, initial state makes a baryon-antibaryon pair production at an electron-positron collider a perfect system to test discrete symmetries in the baryon sector and to study baryon properties. In particular the  $1e10$   $J/\Psi$  events collected at BESIII allow for precision studies of the ground state octet baryon-antibaryon pair production.

The highlight so far is the observation of  $\Lambda$  hyperon polarization in the  $J/\psi \rightarrow \Lambda \bar{\Lambda}$  decay, the result recently published in Nature Phys. (Nature Phys. 15, 631 (2019)). The polarization allows to determine both the  $\Lambda \rightarrow p \pi^-$  and  $\bar{\Lambda} \rightarrow \bar{p} \pi^+$  decay asymmetries. Of major importance is the result for the  $\Lambda \rightarrow p \pi^-$  asymmetry parameter of  $0.750 \pm 0.009 \pm 0.004$  which is 17(3)% larger than the reference value used in all experiments measuring  $\Lambda$  polarization for nearly 50 years. Studies of the remaining ground state baryon-antibaryon pairs under way and preliminary results will be presented e.g. for  $\Sigma^+ \Sigma^-$  where the polarization is also observed.

The  $e^+e^- \rightarrow \Lambda \bar{\Lambda}$  reaction was studied at BESIII also outside the  $J/\psi$  resonance at c.m. energy of 2.396 GeV. The result is the first complete determination of the time-like elastic form factors  $G_M$  and  $G_E$  including the relative phase of  $(37 \pm 12 \pm 6)^\circ$  (PRL 123 (2019) 122003).

About 10 billion  $J/\psi$  events have been collected by the BESIII detector at BEPCII recently. The decay rates of  $J/\psi$  to hyperon anti-hyperon ( $\Lambda$ ,  $\Sigma$ ,  $\Xi$  etc.) are at the order of  $10^{-3}$ , therefore about a few millions of quantum-correlated hyperon-anti-hyperon pairs, which allows to measure the decay parameters (including CPV) and polarizations with higher precision. In particular, it is also offer a unique opportunity to investigate the CP asymmetry in the hyperon production (EDM) and decays, as well rare hyperon decays, which are sensitive to the physics beyond Standard Model. In this talk, the recent results on hyperon physics will be reported.

## I read the instructions

## Secondary track (number)

**Primary author:** SCHOENNING, Stina Karin

**Presenter:** SCHOENNING, Stina Karin

**Session Classification:** Strong Interactions and Hadron Physics

**Track Classification:** 06. Strong Interactions and Hadron Physics