

Λ Polarization (P_Λ) Measurement of the $\pi^-p \rightarrow K^0\Lambda$ Reaction in J-PARC E40 Experiment

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We performed the J-PARC E40 experiment to measure the Σp scattering from 2018 to 2020. Together with the $\pi^-p \rightarrow K^+\Sigma^-$ data, the $\pi^-p \rightarrow K^0\Lambda$ events were accumulated as by-product data. The analysis confirmed that Λ could be identified with reasonable accuracy of S/N ratio ~ 2.67 . Plus, we found the polarization of Λ (P_Λ) was preliminarily derived as 1.009 ± 0.049 for the K^0 angular range of $0.7 < \cos\theta_{CM,K^0} < 0.8$, using the following equation:

$$\frac{1}{N_0} \frac{dN}{d\cos\theta_p} = \frac{1}{2} (1 + \alpha P_\Lambda \cos\theta_p),$$

where N_0 is the yield of the decay proton, α is the asymmetry parameter ($= 0.750 \pm 0.009 \pm 0.004$). This result has higher accuracy than the past measurement [1].

The result above indicates that we can measure not only the Λp differential cross-section ($(d\sigma/d\Omega)_{\Lambda p}$) but also spin observables such as analyzing power (A_y) and depolarization (D_{yy}) with $\sim 100\%$ polarized Λ beam. These quantities are essential inputs for establishing the realistic ΛN interaction.

Therefore, we plan a new Λp scattering experiment at J-PARC K1.1, Ibaraki, Japan [2] to measure $(d\sigma/d\Omega)_{\Lambda p}$, A_y and D_{yy} with better than 10% accuracy. I will mainly talk about the P_Λ analysis in J-PARC E40 data and briefly introduce the next Λp scattering experiment.

[1] R. D. Baker et al., Nucl. Phys. B 141, 29 (1978).

[2] K. Miwa et al., J-PARC proposal P86., 2021.

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