Near threshold hyperon production in pp collisions

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We report on a model calculation for the reactions $pp \to p\Lambda K^+$ and $pp \to N\Sigma K$ near their thresholds. We treat the associated strangeness production in the standard distorted wave Born approximation. We assume that the strangeness production process is governed by the π- and K exchange mechanisms. The elementary amplitudes T_{KN} and $T_{\pi N \to KY}$ are taken from corresponding microscopic models [1,2] that were developed by our group. For simplicity reasons we use the scattering length and on-shell threshold amplitudes, respectively, instead of the full (off-shell) KN and $\pi N \to KY$ t-matrices. However, the final state interaction in the outgoing hyperon-nucleon (YN) system is taken into account rigorously. For that purpose we employ microscopic YN interaction models developed by the Jülich group [3,4]. These models are derived in the meson-exchange picture and take into account the coupling between the ΛN and ΣN channels.
It was shown in Ref. [5] that our model can account for the experimentally observed large cross section ratio $\sigma_{pp\to p\Lambda K^+}/\sigma_{pp\to p\Sigma^0 K^+}$ near threshold. This ratio is about 30 [6] – as compared to higher energies where it is around 3. However, such a large ratio can only be achieved if a destructive interference between the π and K exchange contributions in the reaction $pp \to p\Sigma^0 K^+$ is assumed. In the present contribution we want to explore the consequences of such a destructive interference between those two production mechanisms for other Σ production channels, and specifically for $pp \to p\Sigma^+ K^0$ and $pp \to n\Sigma^+ K^+$ which are presently under experimental investigation at the COSY facility in Jülich.

References

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