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Λ-Λ hyperons: journey towards the understanding of the hyperon-hyperon interactions in neutron stars

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For the P̄ANDA@HADES collaboration Hyperons, baryons incorporating at least one strange quark in the composite, are the focus of research due to several physics interests. A particularly exciting area is the investigation of interactions between hyperons, which could offer insights into the nature of hyperonization and matter in extreme conditions such as neutron star cores [1]. Hyperons, especially lambda (Λ) hyperons, are expected to appear in the core of neutron stars where the density exceeds nuclear saturation density. Their presence significantly softens the equation of state, affecting the maximum mass and radius of neutron stars leading to a discrepancy between the observation and model based predictions [2]. This study embarks on a comprehensive exploration of Λ-Λ interactions at low relative momenta. As a first step the production cross-section the Λ-Λ hyperon channel, pp → ΛΛKˆ+ K+, at a proton beam energy of 4.5 GeV (√s = 3.46 GeV) was measured at GSI, using the High Acceptance Di-Electron Spectrometer (HADES) [3, 4]. In this talk I will outline the analysis procedure and present a preliminary result for the production cross section as well as the Λ-Λ relative momentum distribution.

[1] D. Chatterjee and I. Vidaña, "Do hyperons exist in the interior of neutron stars?," The European Physical Journal A, vol. 52, pp. 1–18, 2016.
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[3] G. Agakishiev et al. Eur. Phys. J. A, vol. 41, pp. 243–277, 2009.
[4] J. Adamczewski-Musch et al., "Production and electromagnetic decay of hyperons: a feasibility study with hades as a phase-0 experiment at fair," The European Physical Journal A, vol. 57, pp. 1–21, 2021.

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