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Dilepton production and anisotropy in pion-nucleon collisions

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The study of virtual photon polarisation in time-like baryon electromagnetic transitions allows for the extraction of crucial information about the nature of particles and interactions at a fundamental level. Recent research has considered the transition $\pi^- p \to n e^+ e^-$ with respect to the polarisation of the virtual photon, which has an impact on the angular distribution of the emerging lepton pair at a center of mass energy of $\sqrt{s} = 1.49\,\text{GeV}$ [1], which matches the experiment at HADES (High Acceptance Di-Electron Spectrometer) at GSI [2]. A phenomenological model is used, based on effective Lagrangians [3] including the vector meson dominance model [4], which allows to split up the process into a production part $\pi N \to N\gamma^*$ and a decay part $\gamma^* \to e^+ e^-$. We can calculate cross sections, analyse the angular distribution in terms of anisotropy coefficients and furthermore make predictions for the spin density matrix elements of the production process, which then can be compared to the experimental data. We have extended the abovementioned calculations to include the Born terms. Also, with new information on branching ratios of the intermediate nucleon resonances such as N1440, N1520, N1535, Δ1600 available, we are able to give an updated view on existing calculations. Furthermore we include higher mass resonances to provide calculations for higher beam energies at $\sqrt{s} = 1.7\,\text{GeV}$, which matches future experiments at HADES[2].

References

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