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Exploring time like transitions in pp, π^- p heavy ion reactions with HADES

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Exploring time like transitions in pp and Xpi−p reactions with HADES

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Radiative transition of an excited baryon to a nucleon with emission of a virtual massive photon decaying to electron-positron pair (R->Ne+e- Dalitz decays) provides important insight into baryon-photon vertex at low q2 =(me+e-)ˆ2 in time-like region. A prominent enhancement in the respective electromagnetic Transition Form-Factors (eTFF) at q2 near the vector meson (rho/omega) poles has been predicted by various calculations reflecting strong baryon-vector meson couplings (see for example [1]). The understanding of these couplings is also of great importance for the interpretation of the emissivity of QCD matter studied in heavy ion collisions via dilepton emission [2]. Indeed, model intepretations of thermal radiation rates measured below the vector meson poles show that the dominant contribution originate from rho meson with a spectral function strongly modified by interactions with baryons in the fireball. Both aspects are studied by the HADES collaboration at GSI/FAIR by means of dedicated measurements performed with proton-proton, pion-proton and heavy-ion reactions.
The first measurements of the Dalitz decay of Delta(1232) and of higher mass resonances in p+p collisions have been recently concluded [3, 4], indicating the important role played by rho meson. Two-pion and, for the first time, dielectron production were studied in pion induced reactions on polyethylene and carbon targets in the second resonance region. The two-pion data have been analysed using the Bonn-Gatchina PWA together with results of other experiments allowing for the separation of resonance contributions and their decay channels. In particular the off-shell rho meson contribution has been extracted providing an important constraint for the interpretation of dielectron invariant mass spectra measured in the same reaction. Angular distributions of emitted electrons have been also analysed allowing for the estimation of hadronic spin density matrix elements as a function of virtual photon emission angle, as suggested in [5] They provide independent information about spin and parity of the involved resonances and about virtual photon polarization. This presentation will summarize most important results obtained in proton and pion induced reactions measured with HADES.

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