Dilepton production at SIS energies with the GiBUU transport model*

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The HADES collaboration has recently measured dilepton spectra from pp, pA and AA reactions (see e.g. [1, 2]) in order to investigate in-medium properties of vector mesons and solve the long-standing "DLS puzzle" (for a review see [3]).

We simulate the corresponding reactions with the GiBUU transport model, which provides a unified framework for various types of elementary reactions on nuclei as well as heavy-ion collisions [4]. This model takes care of the correct transport-theoretical description of the hadronic degrees of freedom in nuclear reactions, including the propagation, collisions and decays of particles.

While a string-model approach may still be applicable at the highest HADES energies [5], a resonance-model description of the elementary NN collisions is surely more appropriate below $\sqrt{s} \approx 3\,\mathrm{GeV}$. We have recently extended the GiBUU resonance model, which is based on the Teis analysis [6], to higher energies, in order to have one consistent model for the whole energy regime probed by HADES [7].

Fig. 1 shows a comparison plot of a resonance model simulation to HADES data for p+p collisions at 3.5 GeV. The simulation results have been corrected for the HADES detector acceptance and resolution and provide an excellent description of the data over the complete spectrum.

The ρ contribution to the dilepton spectrum deserves particular attention, since its shape is strongly influenced by the ρ meson's production mechanism via baryonic resonances. In particular the $D_{13}(1520)$ contributes significantly to the low-mass part of the ρ spectral function. Together with the contributions from other resonances (only a few of which are shown in the figure), this results in a rather flat shape of the ρ channel, which dominates the intermediate-mass region of the dilepton spectrum around 600 MeV.

After fixing the cocktail contributions in the elementary reactions, the next step is to investigate heavy-ion collisions. Fig. 2 shows the GiBUU spectrum for Ar+KCl at 1.76 GeV [8] in comparison to the HADES data [1]. The simulation shown here relies on vacuum spectral functions and yields a reasonable agreement with the data in the vector-meson mass region as well as the pion region. In the mass region of 200 - 500 MeV, however, the data are underestimated significantly, and it remains to be seen whether this discrepancy can be resolved by e.g. including in-medium spectral functions or other effects. Even larger medium effects than in ArKCl are expected in the heavier Au+Au system, which we plan to investigate in the future.

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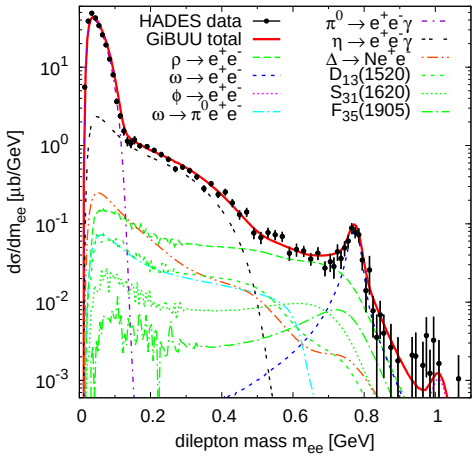

Figure 1: Dilepton spectrum for p+p@3.5GeV compared to HADES data [2].

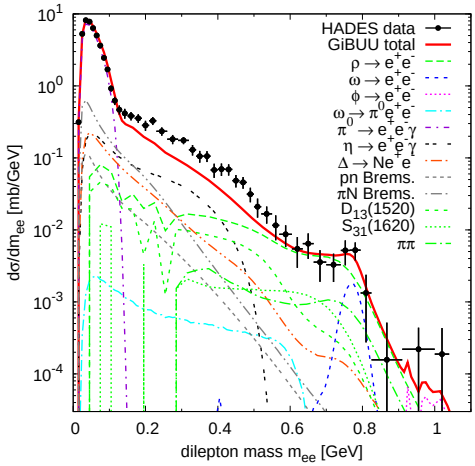

Figure 2: Dilepton spectrum for Ar+KCl@1.76GeV: GiBUU transport simulation compared to HADES data [1].

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