from the lab to neutron stars

Baryons

Report of Contributions

https://indico.lip.pt/e/1283

Contribution ID: **1** Type: **not specified**

Time-like baryon transition studies with HADES

Friday 23 September 2022 09:00 (45 minutes)

The High Acceptance Di-Electron Spectrometer (HADES) [1] installed at GSI is a versatile detector, which was originally designed to study medium effects in e+ e− production in heavy-ion reactions in the SIS-18 energy range (1-2 GeV/nucleon). Its excellent particle identification capabilities allowed for a systematic investigation of dielectron, strange particles and pion production in proton, deuteron or heavy-ion induced reactions on proton or nucleus. The obtained dilepton spectra measured at various beam energies show important contributions from baryon resonance decays (R $\longrightarrow$ N e+e−) and a strong influence of the intermediate vector mesons ($\rho/\omega/\varphi$) in the corresponding time-like electromagnetic form factors [2, 3].

In order to directly access such transitions, HADES has started a dedicated pion-nucleon program using the pion beam line at GSI [4]. For the first time, combined measurements of hadronic and dielectron final states have been performed in π-N reactions in the second resonance region, using polyethylene and carbon targets [5, 6]. While providing new determinations of the baryon-meson couplings, the data allow to investigate the helicity structure of the time like electromagnetic baryon transitions. These results will be presented, together with their confrontation to various versions of the Vector Dominance Model for baryon transitions and to quark-constituent model calculations of time-like electromagnetic transition form factors, emphasizing the role of meson cloud contributions in this kinematical region. Very recently, the proton-proton reaction at 4.5 GeV was measured by the HADES collaboration in an experiment, using the upgraded HADES detector within the FAIR-Phase0 programme [7]. Prospects for baryon electromagnetic transitions studies in the hyperon sector will therefore also be shortly discussed.

References

[1] G. Agakishiev et al. [HADES], Eur. Phys. J. A 41 (2009), 243-277.
[2] J. Adamczewski-Musch et al. [HADES], Phys. Rev. C 95 (2017) no.6, 065205.
[3] G. Agakishiev et al. [HADES] Eur. Phys. J. A 50 (2014), 82.
[4] J. Adamczewski-Musch et al. [HADES], Eur. Phys. J. A53 (2017) 188.
[5] J. Adamczewski-Musch et al. [HADES], Phys. Rev. C 102 (2020) no.2, 024001.
[6] R. Abou Yassine et al. [HADES], arXiv:2205.15914 [nucl-ex].

Presenter: RAMSTEIN, Béatrice

Contribution ID: **2** Type: **not specified**

Probing neutron-star matter in the laboratory

Friday 23 September 2022 09:45 (45 minutes)

The microscopic properties of the strong-interaction matter under extreme conditions of temperature and density is a topic of great current interest. Despite 18 orders of magnitude difference in system size and time, the conditions present in heavy-ion collisions share great overlap with the conditions of the strong-interaction matter in neutron-star mergers. The possibility to form and explore in the laboratory strong-interaction matter under extreme conditions is truly fascinating. Model calculations of the evolution of e.g. temperature and density demonstrate that neutron-star collision regimes can be probed directly at few GeV beam energies. Unravelling the origin of nuclear symmetry energy and its density dependence, understanding the role of the isospin degree of freedom, determining the equation of state of nuclear matter at high density and the presence of a phase transition are among important physics questions. In this talk I will focus on relevant experimental results obtained by the HADES at heavy-ion synchrotron SIS18 in Darmstadt, Germany and will try to establish connections and identify missing links between heavy-ion collisions and collisions involving neutron stars.

Presenter: GALATYUK, Tetyana

Contribution ID: **3** Type: **not specified**

Analysis of Baryon Electromagnetic Transition Form Factors

Friday 23 September 2022 11:45 (45 minutes)

Electromagnetic Form factors give information on the internal dynamics of hadrons. They are theoretical input to hadron transition electromagnetic currents in calculations of the structure of hadrons. Their direct measurement in the space-like and time-like kinematic regime, respectively, is made through differential cross sections and polarization observables of electron scattering and electron-positron annihilation reactions. In this talk I review what a variety of recent experimental data on low-lying nucleon resonance electromagnetic excitations can tell us about the evolution of the relevant degrees of freedom and the photon-baryon couplings in different regimes. The importance of multiquark meson-baryon decay channels and meson-cloud configurations is addressed within a relativistic quark model calculation.

Presenter: TERESA, Peña

Contribution ID: **4** Type: **not specified**

The complex composition of neutron stars: heavy baryons, kaon condensates and light nuclei and hypernuclei

Friday 23 September 2022 11:00 (45 minutes)

A brief review of the connection between the neutron star equation of state and neutron star properties will be presented. The possible appearance of hyperons in the core of neutron stars and its effect on neutron star properties will be discussed. Warm low density matter in binary neutron star mergers or core-collapse supernova matter contains clusterized matter. The possible presence of hyperons and light hypernuclei under these conditions will be analysed.

Presenter: CONSTANÇA, Providência