Contribution ID: **142** Type: **20 min.**

# Why is it interesting to study proton-deuteron collisions at √s ≈ 8.9 −9.7 GeV and - t = 0.6 −1.8 GeV2

*Thursday 18 September 2025 11:20 (20 minutes)*

Currently, there are serious contradictions in the description of p-d scattering at sufficiently high energies and momentum transfer. They manifest themselves not only between theory and experiment, but also between the results of two different experiments of high quality for their time. Thus, the differential cross sections of elastic p-d scattering at √s = 8.9 −9.7 GeV and |t|= 0.6 −1.8 GeV2, obtained at CERN [1] and FNAL [2], differ from each other by about two times. At the same time, the results of calculations of these cross sections performed within the framework of the Glauber model give values noticeably lower than the experimental ones for the both cases.

The difference between theory and experiment, in principle, can be explained using the idea of polymorphism of nuclear matter, which allows for the presence of hexaquark admixture in the deuteron [3]. For large momentum transfer, scattering on hexaquarks occupying a small spatial volume can give a significant contribution to the cross-sections. If the hexaquark, after being knocked out of the nucleus, turns into a deuteron, then it becomes clear why the Glauber model, which describes scattering on the nucleus in terms of scattering on its nucleons, does not explain the experimentally observed elastic scattering cross sections.

In addition, the hexaquark, after being knocked out of the nucleus, can with some probability transform into the excited state of the deuteron –dibaryon d. *Some features of registration of dibaryons in colliding beams of protons and deuterons at the NICA SPD will be discussed too in this report. The relevance of setting up such an experiment at present is inspired by registrations of some new light dibaryons, which have been announced in [4, 5]. If such light dibaryons do exist, then for inelastic p + d –> p + d* events scattered proton momentum losses fell in the kinematic region close to those for the elastic processes. Due to errors in measurement of scattered protons momenta, such events might be classified as elastic ones in [1]. Perhaps this explains the difference in the differential cross sections of elastic scattering obtained in [1] and [2].

References

1. U. Amaldi et al., Nucl. Phys. B39 (1972) 39
2. J. Engler et al., Nucl. Phys. B62 (1973) 160
3. V. A. Matveev, P. Sorba, Lett. Nuovo Cim., 20 (1977) 435
4. T. Ishikawa et al., Nucl. Phys. B789 (2019) 413
5. T. C. Jude et al., arXiv:2202.08594 [nucl-ex]

**Author:** KOSTENKO, Boris (JINR)

**Presenter:** KOSTENKO, Boris (JINR)

**Session Classification:** Projects NICA/MPD/SPD/BM@N at JINR

**Track Classification:** Projects NICA/MPD/SPD/BM@N at JINR