Contribution ID : **23** Type : **plenary talk**

Pion Production in NN Collisions and the Issue of Dibaryons *)

Monday, 11 June 2018 10:00 (0:30)

Collaboration

WASA-at-COSY

Abstract content

Since pions are the lowest-mass messengers of subnucleonic degrees of freedom, the production of one or more pions in nucleon-nucleon collision processes is outstandingly suited to search for resonances in the two-baryon system. Already in the fifties, first experiments on single-pion production found first indications for a resonance near the ΔN threshold. But it took until the beginning of this millennium when the first non-trivial, narrow dibaryon resonance could be established by WASA at COSY. The dibaryon resonance $d^*(2380)$ with $I(JP) = 0(3+)--$ first observed in the double-pionic fusion to the deuteron – has meanwhile been detected by WASA in all relevant two-pion production channels. In addition, its resonance pole has been revealed in neutron-proton scattering. Theoretical calculations describe this state either as a compact hexaquark or a dilute molecular-like object. Whereas the d^* decay into two-pion channels does not discriminate between these two scenarios, the decay into single-pion channels is very discriminatory. In the hexaquark case, this decay is heavily suppressed with a branching less than 1%. In the molecular-like case a branching of as much as 18% is expected. In order to clarify this situation, we have measured the isoscalar single-pion production in the energy region of $d^*(2380)$. As a result, we find no evidence for such a decay with an upper limit of 9%. This is in support of a compact hexaquark system being the dominant configuration. Reexamining the $pp \to pp\pi^+\pi^-$ reaction at higher beam energies we find evidence for an isotensor dibaryon resonance near the ΔN threshold. It fits very well to the calculations of Gal and Garcilazo as well as to the predictions of Dyson and Xuong. It is remarkable that now five out of the six dibaryon states predicted by Dyson and Xuong have been observed. For the sixth state with $I = 3$ so far only upper limits have been deduced from four-pion production, but this needs further, more detailed investigations. Whereas all these resonances are asymptotically composed of baryons in relative s-wave, ANKE at COSY has recently found evidence for ΔN resonances, where the two constituents are in relative p-wave. This demonstrates that there are much more possibilities to form resonances in the system of two baryons than thought before – and there may be still many surprises to come in the dibaryon issue.

*) supported by DFG (CL214/3-2) and STFC (ST/L00478X/1)

Primary author(s) : SKORODKO, Tatiana (Physikalisches Institut, Univ. Tuebingen, Germany)

Co-author(s) : CLEMENT, Heinz (Physikalisches Institut, Univ. Tuebingen, Germany); MIKHAIL, Bashkanov (University of Edinburgh, UK)

Presenter(s) : SKORODKO, Tatiana (Physikalisches Institut, Univ. Tuebingen, Germany)

Session Classification : Plenary Session