SEARCH FOR NARROW DIBARYON RESONANCES IN DEUTERON BREAK-UP REACTION pd→ppn AT 1 GeV IN COMPLETE KINEMATICS EXPERIMENT

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Recently narrow structures in the pp- and pn-effective mass distributions were found in a bubble chamber experiment. The pd → ppn reaction has been studied and an apparent peak at 2.15 GeV with a width of 22 MeV (FWHM) together with some others have been regarded as candidates for dibaryon resonances [1].

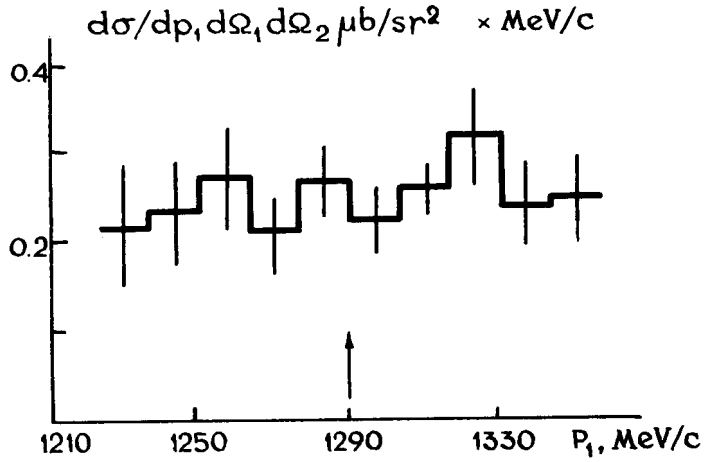

Fig. Momentum spectrum of protons at 15°. Position of resonance expected ($m_R = 2.15$ GeV, $\Gamma = 22$ MeV) is shown by arrow. Three bins correspond to width $\Gamma = 22$ MeV

Here are the results of our investigation of the same reaction but using another method. We used a two-arm spectrometer at kinematical conditions very favourable for an observation of the 2.15 GeV structure mentioned above.

In our experiment the forward fast proton has been detected by the magnetic spectrometer at the angle $\Theta_1 = 15°$. Its momentum resolution $\Delta p/p = 10^{-2}$ (FWHM) corresponded to the missing mass resolution of the np-system $\leqslant 10$ MeV in the mass range close to 2.15 GeV. The backward recoil proton coming from the 2.15 GeV dibaryon decay or from the deuteron break-up reaction background has been registered by a large acceptance scintillation spectrometer at $\Theta_2 = 115°$. Along with the magnetic analysis, the criteria of the time of flight and the energy loss in the counters of the scintillation spectrometer have been used for separating the pd→ppn reaction events from those of the pion production background reaction.

Table

Upper limit of total cross section of dibaryon production
(M — spin projection of resonance to its momentum direction)

$^{2S+1}L_J$, polarization state	angular distribution	σ, μb
$^3P_1$, M=0 ; $^1P_1$ M=1 $^3P_2$, M=2	$\sin^2\theta$	9
$^1P_1$, M=0	$\cos^2\theta$	17
$^3P_1$, M=1 $^3P_2$, M=1	$1+\cos^2\theta$	20
$^3P_2$, M=0	$1+3\cos^2\theta$	12
$^1D_2$, M=2	$\sin^4\theta$	7
$^1D_2$, M=1	$\frac{1}{2}\sin^4\theta+\sin^2\theta\cos^2\theta$ $+\frac{1}{2}(3\cos^2\theta-1)^2$	9
$^1D_2$, M=0	$(3\cos^2\theta-1)^2$	90
$^1S_0$, $^3S_1$, $^3P_0$	isotropic distribution	17

The experimental momentum spectrum of the forward protons normalized on the elastic pp--scattering is shown in fig. The momentum range measured corresponds to the effective mass range from 2.11 to 2.18 GeV. The experimental errors include the uncertainties of the statistics and the monitoring of the proton beam. In addition, there is the overall systematic uncertainty ($\sim$10%) due to the normalization error of the differential cross section of the elastic pp-scattering.

Our experimental data do not display any features which might be considered as evidence of the narrow dibaryon resonances. The table contains some possible quantum numbers of the resonance, its polarization states, the angular distributions of the decay products in its own frame and the upper limits of the cross sections of the dibaryon production. We supposed that the differential cross section for the dibaryon products does not exceed 2 standard deviations for that of the pd→ppn reaction.

Thus we do not confirm the existence of resonance in the mass range from 2.11 to 2.18 GeV with the width $\Gamma = 22$ MeV, the total spin $J \leqslant 2$, if the total cross section is more than 10 — 20 μb. The only exclusion is the $^1D_2$, $M = 0$ resonance. In this case the kinematical conditions were not optimal for detecting the decay proton. For this reason a special experiment has been carryed out at $\vartheta_2 = 80°$. The treatment of this run is in progress now.

REFERENCES

1. *Andreev V. P. a. o.* Preprint LNPI — 1217, Leningrad. 1986.
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