

**PHASE ANALYSIS OF π -MESON SCATTERING BY HYDROGEN
AT 310 MeV**

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(Speaker I.M.VASILEVSKII)

This paper gives a phase analysis of the scattering of π mesons by hydrogen while making use of new experimental data on 1. the polarization of the recoil protons in elastic π^-p scattering at 300 MeV [1]; 2. Data on elastic scattering of π^- and π^+ mesons by hydrogen, and on exchange scattering at an energy of 310 MeV [2,4]; 3. Data on the polarization of the protons in π^+p scattering [5] and on the polarization of the recoil neutrons in exchange scattering [6]; 4. the total cross sections for the

interaction of π^+ and π^- mesons at this energy [2, 3]. The search for possible sets of phase shifts (SPD-analysis) was carried out by the method of random samples for phase shifts with an isotopic spin 1/2 with the help of part of the above-indicated experimental data. Three sets were obtained and were found to be similar to those found by Vik et al. [7].

The phase analysis using all the experimental data for 310 MeV and allowing for the SPD- and SPDF-waves for the three-phase sets

Parameter	Set					
	I		II		III	
$S_{3,1}$	-20.2 ± 0.5	-18.9 ± 1.1	-19.6 ± 0.6	-21.8 ± 0.5	-18.1 ± 0.7	-16.4 ± 1.4
$P_{3,1}$	-6.0 ± 0.5	-4.6 ± 0.6	-5.6 ± 0.6	-11.3 ± 1.1	-4.3 ± 0.5	-1.2 ± 1.7
$P_{3,3}$	132.2 ± 0.5	133.5 ± 0.6	135.0 ± 0.6	134.9 ± 0.9	135.0 ± 0.6	134.2 ± 0.7
$D_{3,3}$	1.6 ± 0.4	2.2 ± 1.3	1.3 ± 0.4	-2.8 ± 0.8	2.0 ± 0.4	4.1 ± 1.0
$D_{3,5}$	-3.8 ± 0.4	-4.2 ± 1.0	-3.1 ± 0.4	0.4 ± 1.0	-4.3 ± 0.4	-6.0 ± 0.9
$F_{3,5}$	—	0.4 ± 0.4	—	-1.6 ± 0.5	—	0.6 ± 0.3
$F_{3,7}$	—	-0.2 ± 0.7	—	2.8 ± 0.6	—	-1.2 ± 0.6
$S_{1,1}$	15.2 ± 1.8	17.0 ± 1.2	-6.6 ± 0.8	2.4 ± 0.7	-6.5 ± 1.6	0.9 ± 1.9
$P_{1,1}$	15.5 ± 0.7	19.2 ± 0.9	-3.3 ± 0.5	1.6 ± 0.6	28.6 ± 1.4	28.5 ± 1.1
$P_{1,3}$	-4.7 ± 0.8	-2.4 ± 0.6	2.8 ± 1.2	1.9 ± 0.7	8.1 ± 0.5	9.2 ± 0.8
$D_{1,3}$	3.0 ± 0.2	5.0 ± 0.6	-5.3 ± 0.3	-0.5 ± 0.4	4.9 ± 0.5	2.9 ± 0.8
$D_{1,5}$	0.5 ± 0.4	3.5 ± 0.8	15.2 ± 0.8	13.7 ± 0.6	-0.1 ± 0.3	-0.6 ± 0.7
$F_{1,5}$	—	1.1 ± 0.2	—	-0.1 ± 0.3	—	-3.5 ± 0.6
$F_{1,7}$	—	1.0 ± 0.4	—	3.9 ± 0.4	—	-0.1 ± 0.5
M	95.8	48.0	159.4	72.3	125	65.3
M_{exp}	61	57	61	57	61	57

obtained, which were introduced into the computer as initial data, yielded the results given in the table.

Set II poorly satisfies the polarization data of recoil neutrons [6]. The phase shifts of set I (which is similar to set II of Vik and Rugge) are in close agreement with the phases found for this energy by Roper [8].

DISCUSSION

C. Lovelace

Question to B. Moyer and to J. M. Vasilevskii.

Concerning Prof. Moyer's talk, we have new phases to be presented this afternoon. These fit better than Roper's and differ especially in S_{11} . We find a big inelastic cusp at the η threshold, in agreement with Prof. Moyer's experiment. Due to the Ball-Frazer effect, this causes the S_{11} phase to jump to 60° . Also I would like to ask Dr. Vasilevskii which of the three Vik-Rugge phase sets, his polarization measurements prefer?

B. Moyer

Question: Was the phase shift set preferred in the work reported by Vasilevskii similar to the Vik-Rugge 2 set?

Answer: Yes. This close to the Vik-Rugge 2 set, and also close to that of Roper.

I. M. Vasilevskii

I am only add that the ambiguity in the phase-shift sets remains. As regard set II, the contribution of one polarization point of the recoil neutrons is equal to 14. We prefer set I, which is similar to set II in the Vik-Rugge solution

REFERENCES

1. Vasilevskii I. M. et al. Paper submitted to the Conference on High-Energy Physics, Dubna, 1964
2. Foote J. H. et al. Phys. Rev., 122, 959 (1961).
3. Rugge H. R., Vik O. T. Phys. Rev., 129 2300 (1963).
4. Zinov V. G., Korenchenko S. M. JETP, 38, 1399 (1960).
5. Foote J. H. et al. Phys. Rev., 122, 948 (1961).
6. Hill R. E. et al. Bull. Amer. Phys. Soc., 9, 410 (1964).
7. Vik O. T. et al. Phys. Rev., 129, 2311 (1963).
8. Roper D. Phys. Rev. Lett. 12, 340 (1964).