



Chapitre d'actes

1993

Published version

Open Access

This is the published version of the publication, made available in accordance with the publisher's policy.

N-N elastic scattering and transmission experiments

Bach, Pierre; Demierre, Philippe; Gaillard, Gérald; Hess, Roger; Lomon, Earl L.; Rapin, Divic Jean;
Sormani, Philippe Raymond; Vuaridel, Bertrand

How to cite

BACH, Pierre et al. N-N elastic scattering and transmission experiments. In: CTU Seminar 94. Part A: Mathematics, Nuclear Engineering, Physics, Development of CTU Study, Fluid Mechanics, Theory of Constructions. Prague. Prague : Czech Technical University, 1993. p. 125–126.

This publication URL: <https://archive-ouverte.unige.ch/unige:163859>



N-N ELASTIC SCATTERING AND TRANSMISSION EXPERIMENTS

P. Bach^{1a}, J. Ball², L. S. Barabash³, R. Binz⁴, J. Bystricky⁵, P. A. Chamouard²,
Ph. Chesny², M. Combet², Ph. Demierre¹, J. M. Fontaine², G. Gaillard^{1b},
J. P. Goudour⁶, R. Hess¹, Z. Janout^{3c}, Z. F. Janout^{1d}, V. A. Kalinnikov³,
Yu. M. Kazarinov³, B. A. Khachaturov³, A. Klett⁴, R. Kunne², C. D. Lac^{2e},
J. M. Lagniel², F. Lehar⁵, M. C. Lemaire⁵, A. de Lesquen⁵, E. L. Lomon^{1f},
D. Lopiano⁷, M. de Mali⁵, V. N. Matafonov³, G. Milleret², F. Perrot-Kunne⁵,
I. L. Pisarev³, A. A. Popov³, D. Rapin¹, L. van Rossum⁵, E. Rössle⁴, J. L. Sans²,
H. Schmitt¹, Ph. Sormani^{1g}, H. Spinka⁷, Yu. A. Usov³, B. Vuaridel¹

- 1) DPNC, Univ. of Geneva, 24, q. Ernest-Ansermet, 1211 Geneva 4, Switzerland
- 2) Laboratoire National SATURNE, CE Saclay, 91191 Gif sur Yvette, France
- 3) LNP - JINR, Dubna, 101000 Moscow, P.O.Box 79, Russian Federation
- 4) Faculty of Physics, Freiburg University, 7800 Freiburg im Br., Germany
- 5) DAPNIA, CE Saclay, 91191 Gif sur Yvette Cedex, France
- 6) C.E.N.B., Domaine du Haut-Vigneau, 33170 Gradignan, France
- 7) ANL-HEP, 9700 South Cass Ave., Argonne, IL 60439, USA

Present addresses :

- a) Collège Rousseau, 16A, av. du Bouchet, 1209 Geneva, Switzerland
- b) Schlumberger Ind., 87, rte de Grigny, 91130 Ris Orangis, France
- c) FJFI, Czech Tech. Univ., Břehová 7, 11519 Prague 1, Czech Republic
- d) Comp. Center, Czech Tech. Univ., Žitkova 4, 16635 Prague 6, Czech Republic
- e) Inst.Nat.des Telecom. 9, rue Charles Fourier, 91011 Evry, France
- f) Center of Theoretical Physics, MIT, Cambridge, MA 02139, USA
- g) Brainsoft Consulting S.A., Cusinand 46, 1285 Athenaz, Switzerland

It is essential to have a clear understanding of the nucleon-nucleon interaction as it impacts on a variety of topics in particle physics as well as in nuclear physics. A knowledge of the nucleon-nucleon (NN) interaction is essential in calculating the scattering of nucleons from nuclei. The elastic NN scattering is the basic reaction necessary to understand the nuclear force. Spin effects of the nucleon constituents can be investigated (see ref.[1]).

Here we treat a part of the NN program at SATURNE II carried out by the present large international collaboration. Results concern np and pn elastic and quasielastic scattering and transmission measurements at Saclay. Polarized proton and neutron beams in conjunction with polarized proton and deuteron targets (PPT or PDT) were used in these measurements. The study aims to reconstruct unambiguously the five complex amplitudes of the np or pn reactions over the energy domain of 0.8 to 2.7 GeV. Data taking for the np part is completed. The pn part started recently.

The beam line, the PPT and PDT, the experimental set-up, the trigger and MWPC electronics, the data acquisition and OFF-LINE analysis are described in ref.[2]. We use the

NN formalism and the four-spin notation of observables from ref.[3]. The beam polarization P_B was oriented in the normal (\vec{n}), sideways (\vec{s}) and longitudinal (\vec{k}) directions. The PPT polarization P_T was oriented along \vec{n} and \vec{k} . The polarization of recoil particles was measured in the \vec{n} and \vec{s} directions. Our collaboration also determined the total cross section differences $\Delta\sigma_T$ in np transmission [4]. Polarized neutrons with maximal energy of 1.15 GeV are produced by break-up of vector-polarized deuterons on a Be target. The single scattering observables[5] A_{onon} , A_{oonn} , A_{oonn} , A_{ookk} , A_{osk} were measured with a high accuracy. As examples see Figs 1,2,3. The rescattering parameters D_{onon} , $D_{os'ok}$, K_{onno} , $K_{os'ao}$, $K_{os'ko}$, N_{onkk} , N_{osk} were measured simultaneously with lower statistics. Each observable has been measured at 6 to 8 energies. This complete set, together with known differential cross sections makes it possible to reconstruct all np scattering amplitudes directly from observables. Results above 0.8 GeV were determined for the first time.

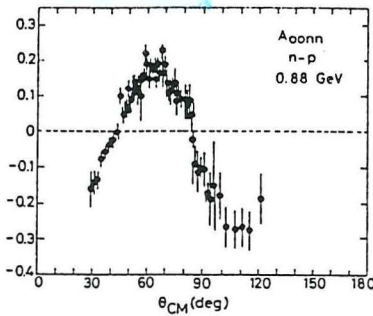


Fig. 1

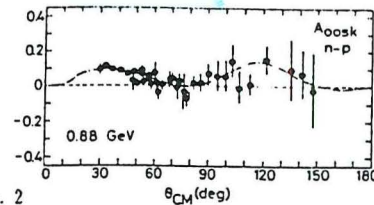


Fig. 2

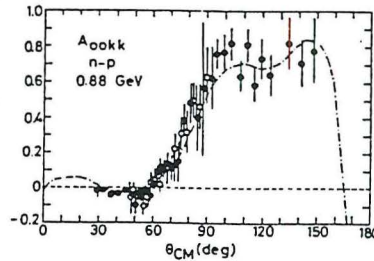


Fig. 3

It is possible to reach an energy above 1.1 GeV for the np system using incident protons scattered on target neutrons. A ${}^6\text{LiD}$ PDT was used for simultaneous measurement of γn and pp quasielastic scattering. First measurements of A_{onon} , A_{oonn} , A_{oonn} , D_{onon} , and K_{onno} were performed between 1.1 and 2.4 GeV.

References:

- [1] LECHANOINE-LELUC, C. - LEHAR, F. Rev. Mod. Phys. **65** (1993) 47
- [2] BALL, J. et al.: Nucl.Instrum.Methods **A327** (1993) 308
- [3] BYSTRICKY, J. - LEHAR, F. - WINTERNITZ, P.: J. Phys. (Paris) **39** (1978) 1
- [4] BALL, J. et al.: Zeitschrift für Physik C, to be published
- [5] BALL, J. et al.: Nucl.Phys. **A559** (1993) 477, 489, 511