

A COMMENT ON FIXED J -PLANE SINGULARITIES IN PHOTOPRODUCTION

BY A. BIAŁAS, A. GOLEMO AND B. GORCZYCA

Institute of Physics, Jagellonian University, Cracow*

(Received April 23, 1970)

An experimental test of the hypothesis that fixed j -plane singularities dominate the high-energy photoproduction is discussed.

There exists now a substantial evidence that the photoproduction reactions in the GeV range do not show any significant shrinkage of the forward and backward peaks [1]. It was recently interpreted by Fox [2] as "strong evidence for fixed poles in photoproduction".

The idea that fixed singularities in the j -plane are dominating the photoproduction processes has far-reaching consequences. One of them is that, as pointed out by Fox, since such fixed singularities are not possible in strong interactions, "the vector dominance model relating photoproduction and vector meson production needs reappraisal" [2].

One obvious way to test whether the non-shrinking peaks in photoproduction are caused by fixed singularities, or rather by a particular combination of several moving singularities¹, is to look whether the property of nonshrinkage is specific to photoproduction or is shared also by some strong processes. From the point of view of the vector dominance model, a particularly interesting case is that of ϱ production, which should dominate most of the photoproduction. It is clear that, unless ϱ production does show a significant shrinkage, the evidence for fixed poles in photoproduction is not proved.

In the present paper we have determined the effective trajectory α_{eff} defined by the formula

$$\frac{d\sigma}{dt} = A(t)P_{\text{lab}}^{2(\alpha_{\text{eff}})} \quad (1)$$

for 3 different ϱ production processes [4]. Within rather large errors there is no evidence for any shrinkage of the forward peak. This is illustrated in Figs 1, 2 and 3, where $\alpha_{\text{eff}}(t)$ is plotted against t for $\pi^-p \rightarrow \varrho^0 n$, $\pi^-p \rightarrow \varrho^- p$ and $\pi^+p \rightarrow \varrho^0 N^{*++}$ respectively. Certainly

* Address: Instytut Fizyki UJ, Kraków 16, Reymonta 4, Polska.

¹ As for instance in πp elastic scattering, see Ref. [3].

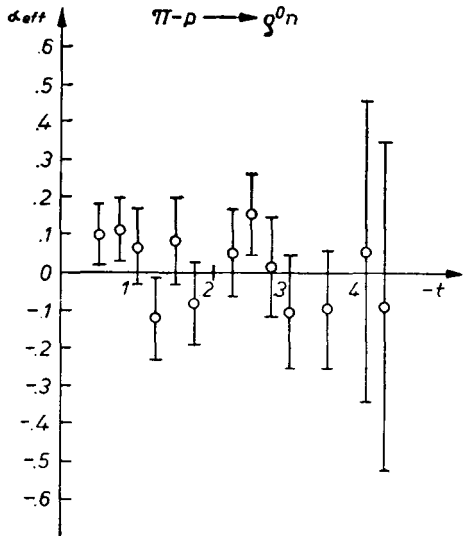


Fig. 1

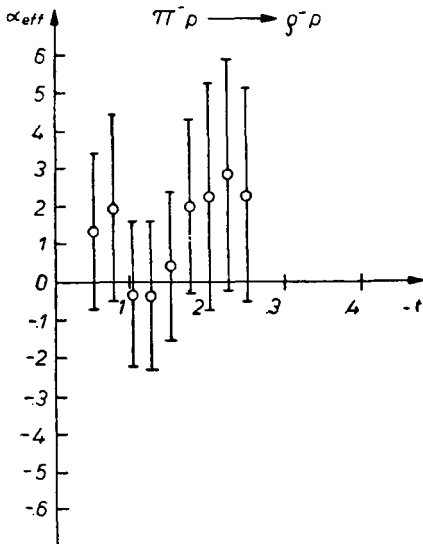


Fig. 2

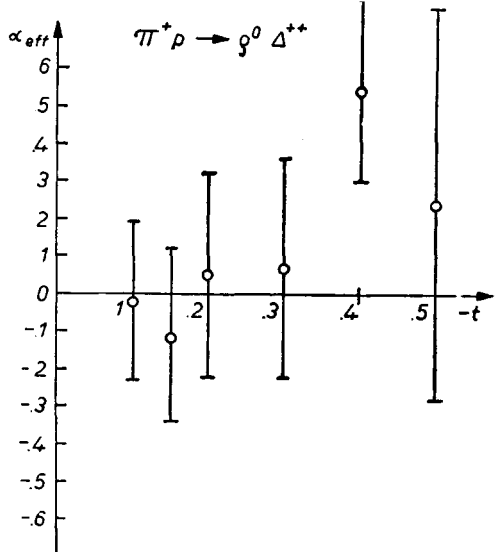


Fig. 3

better data are needed to draw definite conclusions, but it is obvious that existing data do not indicate any shrinkage in ϱ production.

We conclude that the final decision as to whether the fixed singularities in the j -plane dominate the photoproduction reactions, must wait until better data concerning ϱ production are available.

The authors thank Drs A. Kotański and K. Zalewski for helpful criticism.

REFERENCES

- [1] B. Richter, *Proceedings of the Conference on High-Energy Physics*, Vienna 1968; R. Diebold, *Review Talk Presented at High-Energy Physics Conference*, Boulder, Colorado, August 1969.
- [2] G. C. Fox, *Proceedings of the Third International Conference on High-Energy Collisions*. Stony Brook, New York 1969.
- [3] R. J. N. Phillips, W. Rarita, *Phys. Rev.*, **139B**, 1336 (1965).
- [4] The data for g^0 are taken from:
 - 2.7 GeV/c
D. H. Miller, L. Gutay, P. B. Johnson, F. J. Loeffler, R. L. McIlwain, R. J. Sprafka, R. B. Willmann, *Phys. Rev.*, **153**, 1423 (1967).
 - 4 GeV/c
P. B. Johnson, J. A. Poirier, N. N. Biswas, N. M. Cason, T. H. Groves, V. P. Kenney, J. T. McGahan, W. D. Shephard, L. J. Gutay, J. H. Cambell, R. L. Eisner, F. J. Loeffler, R. E. Peters, R. J. Sahni, W. L. Yen, I. Derado, Z. G. T. Guiragossian, *Phys. Rev.*, **176**, 1651 (1968).
 - 4.2 GeV/c
R. L. Eisner, P. B. Johnson, P. R. Klein, R. E. Peters, R. J. Sahni, W. L. Yen, G. W. Tautfest, *Phys. Rev.*, **164**, 1699 (1967).
 - 5.1 GeV/c
Bari-Bologna-Florence-Orsay Collaboration, paper submitted to Vienna Conference on Elementary Particles, 1968.
 - 6 GeV/c
F. L. Judd, Iowa State University, *Ph. D. Thesis* 1967, as quoted by G. V. Dass, C. D. Froggatt, *Nuclear Phys.*, **B8**, 661 (1968).
 - 7 GeV/c
B. Y. Oh *et al.*, University of Wisconsin, as quoted by G. V. Dass, C. D. Froggatt (above).
 - 8 GeV/c
J. A. Poirier, N. N. Biswas, N. M. Caso, I. Derado, V. P. Kenney, W. D. Shephard, E. H. Synn, H. Yuta, W. Selove, R. Ehrlich, A. L. Baker, *Phys. Rev.*, **163**, 1462 (1967),
J. F. Allard, J. Hennessy, R. Huson, A. Lloret, J. Six, J. J. Veillet, G. Bellini, M. diDorato, E. Fiorini, P. Negri, M. Rollier, *Nuovo Cimento*, **50A**, 106 (1967).
 - 11.2 GeV/c
B. D. Hyams, W. Koch, D. C. Potter, J. D. Wilson, L. Von Lindern, E. Lorentz, G. Lütjens, U. Stierlin, P. Weilhammer, *Nuclear Phys.*, **B7**, 1 (1968).
 - 15 GeV/c
G. Bellini, B. Dugeras, D. Fournier, J. Hennessy, A. Lloret, H. J. Lubatti, J. Six, J. J. Veillet, M. diDorato, E. Fiorini, K. Moriyasu, P. Negri, M. Rollier, H. H. Bingham, B. Equer, C. W. Farwell, W. B. Fretter, *Nuovo Cimento*, **53A**, 798 (1968).
- The data for g^- are taken from:
 - 2.7 GeV/c
D. H. Miller, L. Gutay, P. B. Johnson, F. J. Loeffler, R. L. McIlwain, R. J. Sprafka, R. B. Willmann, *Phys. Rev.*, **153**, 1423 (1967).
 - 4 GeV/c
Aachen-Birmingham-Bonn-Hamburg-London (I.C.)-München Collaboration, *Nuovo Cimento*, **31**, 729 (1964).
 - 4.2 GeV/c
W. L. Yen, R. I. Eisner, L. Gutay, P. B. Johnson, P. R. Klein, R. E. Peters, R. J. Sahni, G. W. Tautfest, *Phys. Rev. Letters*, **18**, 1091 (1967).

8 GeV/c

I. Derado, J. A. Poirier, N. N. Biswas, N. M. Cason, V. P. Kenney, W. D. Shephard, *Phys. Letters* **24B**, 112 (1967).

The data for $\rho^0\Delta^{++}$ are taken from:

3.4 GeV/c

D. Brown, G. Gidal, R. W. Birge, R. Bacastow, S. Yiu Fung, W. Jackson, R. Pu, *Phys. Rev. Letters*, **19**, 664 (1967).

4 GeV/c

Aachen-Berlin-Birmingham-Bonn-Hamburg-London (I.C.)-München Collaboration, *Nuovo Cimento*, **35**, 659 (1965).

7 GeV/c

P. Statterly, H. Kraybill, B. Forman, T. Férbel, *Nuovo Cimento*, **50A**, 377 (1967).

8 GeV/c

M. Aderholz, J. Bartsch, M. Deutschmann, G. Kraus, R. Speth, G. Grote, K. Lanius, S. Nowak, M. Walter, H. Böttcher, T. Byer, V. T. Cocconi, J. D. Hansen, G. Kellner, A. Mihul, D. R. O. Morrison, V. Moskalev, H. Tofte, *Phys. Letters*, **27B**, 174 (1968).

Aachen-Berlin-Cern Collaboration, *Nuclear Phys.*, **B8**, 45 (1968).

5 GeV/c

Bonn-Durham-Nijmegen-Paris-Strasbourg-Turin Collaboration, paper submitted to *Heidelberg Conference on Elementary Particles*, August 1967.

13.1 GeV/c

J. A. Gaidos, R. B. Willmann, J. W. Lamsa, C. R. Ezell, F. T. Meiere, *Purdue University*, Preprint COO-1428-144, August 1969.