



CM-P00073534

Proposal for an Emulsion Exposure to High Energy K^- MesonsJ. SactonI. INTRODUCTION

At the last Aix-en-Provence International Conference on Elementary Particles, the Bristol-Brussels-London-Collaboration has presented evidence of the production of very heavy hyperfragments (with mass numbers ranging from 60 to 90) in the interactions of 800 MeV/c K^- mesons (1). The analysis was based on the observation of about 400 hyperfragments. These hyperfragments were found to differ markedly from those produced in K^- mesons absorptions at rest in the following respects :

- (a) in at least $65 \pm 4\%$ of cases they come from heavy emulsion nuclei, in contrast to the situation for K mesons at rest where most hyperfragments appear to originate in light nuclei (2);
- (b) the proportion of hyperfragments of ranges shorter than 5 m is 88% compared with 63% for hyperfragments produced by stopped K^- mesons (3);
- (c) the non mesonic to mesonic decay ratio of $11.5 \pm .6$ is much higher than that for hyperfragments produced by K^- mesons at rest, i.e. $3.1 \pm .8$ (4);
- (d) the short range hyperfragments, which all decayed non mesonically, are characterized by the rarity of short prongs ($2 \leq R < 30 \mu\text{m}$) in their decay stars : $13 \pm 3\%$ compared with $\sim 40\%$ for the non mesonic hyperfragments produced by stopped K^- mesons;
- (e) the hyperfragments are emitted predominantly in the forward direction.

All these observations indicate that the hyperfragments produced in K^- mesons interactions at 800 MeV/c are heavier than those produced by stopped K^- mesons. According to the model proposed in reference I the Λ^0 hyperon produced in the interaction of the K^- meson with the nucleons is often trapped in the highly excited residual nucleus and remains there until it decays. Further evidence for this model was given recently by N.N. NICKOLLS et al (5) and J.R. KENYON (6) using also K^- mesons of 800 MeV/c momentum.

In an attempt to estimate the average value of the momentum imparted to the heavy hyperfragments produced in the interactions of 800 MeV/c K^- mesons, a detailed analysis of the parent stars of these hyperfragments has been made in Brussels (in collaboration with J. ZAKRZEWSKI of the University of Warsaw). The result of this study will be published shortly.

The production of hyperfragments in the interactions of 1.5 GeV/c K^- mesons is now in progress in Brussels (K^- European Collaboration) in an emulsion stack exposed at C.E.R.N. in early 1962.

II. AIM OF THE EXPERIMENT

We intend to extend the study of the hyperfragments produced in K^- mesons interactions to higher incoming momentum, i.e. 3 - 6 GeV/c (see Em C 61/11 addition I p. 2).

Our purposes are :

(a) to study the dependance of the production processes with the energy of the K^- meson; it should be of interest not only to analyze the production processes of heavy hyperfragments but also to get information on the spallation of heavy nuclei.

(b) by comparing K^- star containing or not a hyperfragment.

(c) to obtain an estimation of the binding energy of the Λ^0 hyperon in heavy hyperfragments. In connection with this problem, it is of importance to mention that some evidence has recently been obtained of

the mesonic decay of heavy hyperfragments. Events of this type, which would allow a rather accurate determination of B_{Λ} , have already been observed in Chicago, London and Brussels. More statistics will be helpful to get definitive conclusions.

(d) to analyze the stimulated decay of the Λ^0 hyperon in heavy hyperfragments.

In addition it should be possible to study the double hyperfragment production (Ξ hyperon or double Λ^0 hyperon production). Let us mention, in connection with this problem, that some triple centered stars have been observed in the interactions of 1.5 GeV/c K^- mesons. These events are now analyzed in detail.

Moreover this experiment would also enable us to accumulate more statistics on Σ^+ hyperons and re-emitted K^0 mesons. This could be of importance in connection with the study of the resonant states K^* , Y^* ... Some evidence of the Y^* effects in the interactions of 800 MeV/c K^- mesons has been reported by E.H.S. BURHOP (Brussels - London Collaboration) at the last C.E.R.N. International Conference (7).

III. EXPERIMENTAL DETAILS

This proposal is submitted by the Brussel group; it is of the light ones by comparison with ordinary light fragments (for example : hammer tracks); however likely that other laboratories of the K^- European Collaboration will also be interested in such an exposure (see En C 61/11 add I p. 2). It is thus difficult to specify the details of the required exposure and stack. It is to be noted that a detailed study of the hyperfragment production processes will need to follow the tracks of energetic particles so that one can already say that the stack will be of large size (~ 200 plates of 10" x 5" x 600 microns). Additional information on these topics and concerning the number of physicists involved will be given after more elaborated discussion with the other interested laboratories.

IV. REFERENCES

- (1) B.D. Jones, B. Sanjeevaiah, J. Zakrzewski, M. Csethey-Barth, J.P. Lagnaux, J. Sacton, M.J. Beniston, E.H.S. Burhop, and D.H. Davis : Proceedings of the Aix-en-Provence International Conference on Elementary Particles - Part I, p 363 (1961) and P.R. 127 - 236 - 1962
- (2) D. Abeledo, L. Choy, R.G. Ammar, N. Crayton, R. Levi Setti, M. Raymond and O. Skjeggstad : N.C. 22 - 1171 - 1961
- (3) European Collaboration, Part I : N.C. 13 - 705 - 1959
- (4) see e.g. J. Sacton : N.C. 18 - 266 - 1961
- (5) N. Nickolls, S. Curtis and D.J. Prowse - Physics Letters I - 327 - 1962
- (6) J.R. Kenyon : preprint 1962.