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Radiation Laboratory

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RESEARCH PROGRESS MEETING

March 25, 1948

by

R. K. Wakerling

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SUMMARY OF THE
RESEARCH PROGRESS MEETING FOR MARCH 25, 1948

by
R. K. Wakerling

Recent n-p Scattering Measurements. K. Brueckner. Thus far 600 proton tracks have been measured with the improved measuring techniques. The data taken under the revised procedure show good agreement with the theoretical energy distribution. The distribution of energy used has a peak at 97 Mev and a width at half height of 46 Mev. In these measurements only proton tracks arising from neutrons of energy greater than 65 Mev were used.

The angular distribution shows rather definitely the asymmetry of the scattering; however, the probable statistical errors are still relatively large. In Figure 1 the variation of scattering with angle is shown in comparison with the measurements taken by Segre's group using coincidence counting techniques. The measurements at large angles are

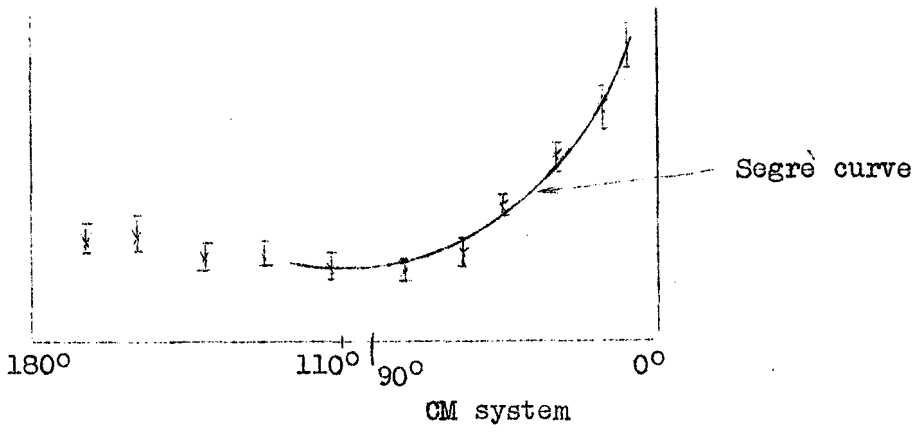

Figure 1

difficult and consequently not very significant. An effort is being made to refine these measuremtns. Thus far no definite conclusion may be reached concerning the scattering above 110° in the center of mass system. The cloud chamber is now being operated at pressure of one and one-half atmospheres so that it seems quite certain that there are no high energy tracks being missed.

E. Segre. A preliminary report on some measurements in the angular range beyond 90° in the center of mass system were reported. The measurements were extended from 90° to 110° with both sets of apparatus previously used. Repeated measurements established the flatness of the scattering curve in this region. The new apparatus of Leith and York should allow the measurements to be extended to 145°. The tentative results in the range of 110° to 142° seem to indicate that the curve rises in this region. However, no great reliance should be placed on these measurements for the instrument was being used at the limit of its capabilities.

Mass Measurements of Mesons. C. Lattes. On the basis of the number of meson tracks ending in stars it was expected that the negative mesons first detected were the heavy ones. To obtain an actual measurement of the mass, the range and radius of curvature were measured for a number of particles. On the basis of 50 measurements the mass was determined to be 313 ± 16 electron masses. The distribution of number with mass exhibits a sharp peak with a half width at half maximum of only 7%. The number of these particles producing stars is considerably over two-thirds. For example, of 52 mesons 41 produced stars.

A search has been made for light mesons. In order to cut the energy to be able to see the particles, glass absorbers were placed in front of

the photographic plates. However, there was not enough resolution to definitely separate another group of light mass. It was noted that those toward the light end do not produce stars. In the range from 140 to 260 electron masses 11 produced stars out of 22, while in the range from 260 to 360, 17 out of 19 produced stars. The stars generally involved less than two particles and of low energy for the light particles (approximately 200 electron masses). The following brief table will give some idea of the number of branches produced by particles of various masses:

Mass	Branches	Mass	Branches
140	0	270	0
144	0	270	5
163	0	278	3
170	1	280	1
171	1	281	2
185	0	282	3
		294	0
		301	6

The measure of the mass of the light particles will also be made by grain counting to confirm the results thus far found from curvature measurements.

Naphthalene Counters. L. Wouters. With the use of photomultiplier tubes scintillation radiation counters become very practical. It has been found that materials like naphtalene, anthracene and benzene are particularly suitable for this purpose. Radiations falling upon these materials produce a considerable amount of light in the visible region which can then be detected by means of a linear photomultiplier tube in conjunction

with an amplifier and an ordinary counting circuit. Such a counter is adaptable for the detection of all types of radiation.

In experiments here, RCA 1P21 and 931A tubes have been used. In the first experimental arrangement a photomultiplier tube was placed in a glass container which in turn was inserted in a second container and the space between them loosely packed with naphthalene flakes. The results obtained with this very simple arrangement were surprisingly good. This counter has numerous advantages over the silver chloride crystal counters in that there are no troublesome space charge effects and no change of sensitivity with time. With the silver chloride crystal counter an extremely elaborate electronic set-up is necessary to overcome the space charge effects through periodic reversal of the potential on the crystal.

It has been discovered that the clarity of the crystal used does not seem to affect the results. However, use is made of the clearest crystals that can be obtained. As yet no attempt has been made to try liquids although this will be attempted.

A more elaborate arrangement was employed in later work in which a photomultiplier tube was surrounded by a container of liquid air to increase the sensitivity of the tube. The naphthalene crystal was placed outside the container and the light focussed on the photomultiplier tube by means of an eliptical reflector. It was hoped that this arrangement would have fairly strong directional properties. However, this was found not to be the case, so that in order to use the counters in directional experiments a coincidence arrangement would be necessary.

A third arrangement has been tried which involves an optical system. The light from the crystal is reflected from a mirror and concentrated by

means of condenser lenses on the photomultiplier tube placed some distance from the crystal. The interpolation of the additional glass of the lenses did not seem to affect the operation. This type of counter exhibits considerable promise, and development work on it is proceeding as rapidly as possible.

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