Title
SUMMARY OF THE WEEKLY RESEARCH PROGRESS MEETINGS OF JULY 3, 10 and 17, 1952

Author
Shewchuck, Sergey S.

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Sergey S. Shewchuck

August 22, 1952

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Berkeley, California

SUMMARY OF WEEKLY RESEARCH PROGRESS MEETINGS OF JULY 3, 10, AND 17, 1952

Sergey S. Shewchuck

August 22, 1952

Meeting of July 3, 1952

I. Progress on Physical Analysis of High Energy Disintegration Products.

W. H. Barkas.

There is a definite need to learn what really goes on in high energy disintegration besides just the chemical analysis of the products. Hence, in this experiment other information was obtained such as: populations of various kinds of nuclei, momentum distributions, angular distributions, variation with beam and energy of beam, and, variation with kind of target (light and heavy elements). A talk has previously been given on some earlier work with this experiment (UCRL-1702 and UCRL-1751).

The apparatus designed for this experiment was fitted with curved channels with radii of curvature of 22-24 cm, 29 1/2 - 31 1/2 cm and 43-45 cm corresponding to the orbits of the particles. At the end of each channel an Ilford film plate was inserted just below the plane of the beam to avoid background as much as possible. Tungsten was used for cover to shield out stray particles. The angular distribution for the angles of 0^{o}, 45^{o} and 135^{o} was obtained with another piece of apparatus. The quantities which could be determined were the angle of entrance, range, position and the number of gaps counted in the tracks of the disintegration products.

Runs were made on many elements but at present only data for protons on Be and C are ready. The targets used had to be thin but, as it turned out, no fragments were identified which required a thinner target. Incidentally, lithium films were cut and rolled to a thickness of 4 mils and then preserved in kerosene.

When the radius of curvature was plotted versus the range, it was found that each different nucleus fell in a special locus. The following graph, Fig. 1, shows the loci for the nuclei of B^8 and Li^8. The loci are labelled as B_5^8, Li_3^8, B_4^8, Li_2^8, etc. where the subscripts indicate the charge carried by the ion when it is bent in the magnetic field.

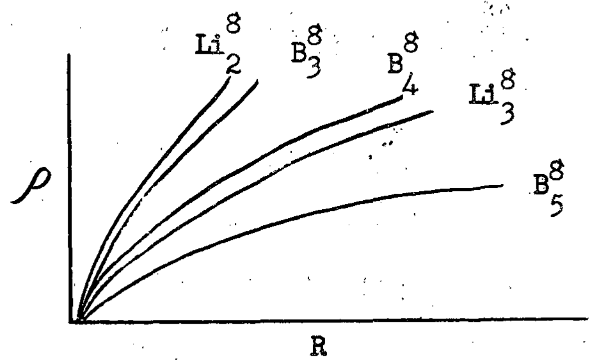

Fig. 1

Another graph, Fig. 2, as follows shows the curves obtained when $\frac{Z^2R}{A}$ is plotted versus T/A, where R is the range and T the kinetic energy.

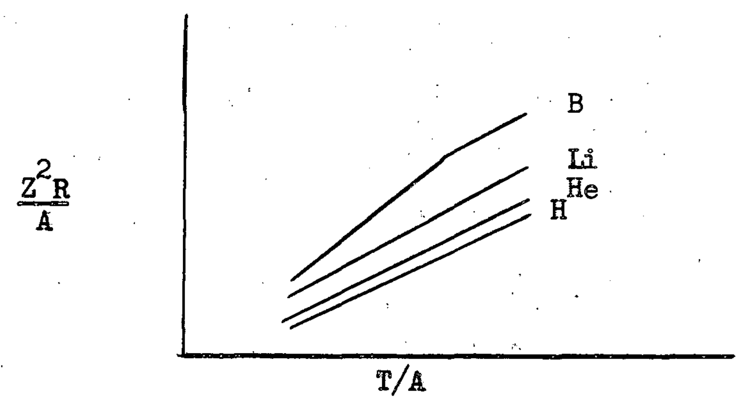

Fig. 2

Table I below shows the data obtained on Be and C with 330 Mev protons. The normalized number of tracks is given in percent per unit solid angle per unit radius of curvature interval. The actual numbers of tracks counted are listed below the percentages in each case. Where the number is uncertain because of poor resolution it is inclosed in parenthesis.

Table I

Radius of Curvature Interval.....	Beryllium products 22-24cm,	29 1/2-31 1/2,	43-45	Carbon products 22-24cm,	29 1/2-31 1/2,	43-45
H^1	11.9% 121	9.73 87	4.43 61	13.3% 106	8.40 69	4.78 38
H^2	4.46 45	3.82 34	3.78 52	2.56 20	3.02 24	3.60 27
H^3	4.59 47	4.15 37	3.45 48	1.82 (14)	1.62 13	1.89 15
He^3	4.86 48	4.73 42	1.67 23	3.55 28	3.50 28	2.22 17
He^4	14.4 146	14.5 143	4.23 58	17.3 137	17.5 143	6.32 49
Li^6, Be^7	.79 (8)	1.24 11	.22 3	.89 (7)	.98 8	.14 1
Li^7	.29 (3)	.34 3	.29 4	.78 (6)	.14 1	.79 6
Li^8	-	-	-	-	.14 1	-
B^8	-	-	-	.14 1	-	-
Unclassified Products and Background	.70 7	.68 6	.64 9	2.16 17	1.23 10	1.18 9

II. The Argonne Radiation Accident. Hardin Jones.

Since the two radiation accidents in question which occurred at Argonne, uranium explosion of June 2 coincident with the Nevada bomb test's "rain-out" in the Chicago area and radium spillage of June 13, are undoubtedly going to be the subject of a report by Argonne in the near future,it is felt that the accident details need not be repeated here. Dr. Jones did make a personal visit to Argonne in the interest of medicine, and, at this meeting he told about the trip and the various factors in the accident stories which he was able to ascertain and which pertained especially to relative lethal doses and the harmful effects observed due to the radiation exposure.

Meeting of July 10, 1952

I. Nuclear Structure in Fission. Ellis Steinberg.

Dr. Steinberg of Argonne during his visit to UCRL gave a talk regarding some of the latest work at Argonne on the fission yield curve. He presented the evidence found previously for the existence of a "peak" on the curve in the region of xenon in the heavy group of the fission products from uranium and other heavy elements, and in particular, for the complementary "peak" in the light group as determined by recent mass spectrometry of Zr, Mo and Ru. He spoke, too, on the places of dissymmetry between the two parts of the curve, on possible attempts to alter the slope characteristics of the curve by use of higher energies and on the interpretation relative to "magic" numbers of neutrons and protons.

II. Ionization Loss at Relativistic Velocities in Nuclear Emulsions. Maurice Shapiro.

While visiting UCRL from the Naval Research Laboratory, Washington, D.C., Dr. Shapiro gave a talk on experiments with minimum grain density values. They indicated an increase in grain density beyond the point of minimum ionization of about 10 percent rather than the originally expected 40 percent. This had not been noted before due to errors greater than 10 percent.

Meeting of July 17, 1952

I. π^- Meson Scattering by Aluminum. J. F. Tracy.

Photographs of tracks from scattering and absorption were obtained using a 340 Mev proton beam on a two-inch polyethylene target in the cave and thence into the cloud chamber which contained in parallel five aluminum plates 3 1/2 inches high and 1/8 inch in thickness. The field was about 5000 gauss. In the 600 usable pictures taken 3976 tracks were observed and carefully examined for scatters, stars, and stops. 628 tracks were measured in detail to determine the incident energy spectrum and to provide information for extrapolating to the thickness of aluminum traversed by the 3976 tracks.

It is a problem to decide at just what angle to cut off scattering events. From 30° down the contributions are largely from coulomb scattering. Above 30° it is believed they are due to nuclear scattering. The following data, Table I, give the tentative differential scattering cross sections for various angles θ:

θ	$\frac{d\sigma}{d\omega}$ (mb/ster.)
10° - 15°	850 ± 150
15° - 20°	440 ± 90
- 25°	140 ± 40
- 30°	150 ± 40
- 60°	14 ± 4
- 90°	1.8 ± 1.3
- 120°	9 ± 3
- 150°	8 ± 3
- 180°	17 ± 8

Table I.

Also tabulated are the numbers of events and total cross sections for all scatters $\geq 30^\circ$, stars and stops for three energy intervals. No corrections have yet been made for μ contamination nor for events around 90° hidden by the geometry. These latter appear as stops. See Table II.

Incident π energy (Mev)	Scatters $\geq 30^\circ$	1 prong Stars	2 prong Stars	Stops	Total	σ(mb)
25 - 45	10	17	5	9	41	246 ± 37
45 - 70	17	11	14	8	50	433 ± 61
70 - 100	7	7	4	3	21	405 ± 88

Table II.

For all tracks counted of scatters $\geq 30^\circ$ and of energies 25 to 100 Mev the total cross section was computed to be 377 ± 36 mb. The errors are the standard deviations based on statistics only.

II. Fine Structure of the Synchrotron Beam. R. Madey.

An abstract of a proposed UCRL report of the same title by R. Madey is being quoted as follows:

"The full energy photon beam (320 Mev bremsstrahlung) of the Berkeley synchrotron was shown to be emitted in sharp bursts with the 47.7 megacycle frequency of the electrons in the doughnut. A two counter telescope was used to measure an accidental coincidence counting rate as a function of the length of delay line in one input to the coincidence circuit. When the length of delay line was chosen to be equal to multiples of one-half of the period of the r.f. oscillator, the coincidence counting rate was less than about 2 counts per unit of integrated beam; on the other hand, when the length of delay cable was chosen equal to multiples of the period of the r.f. oscillator, the coincidence counting rate was of the order of 100 counts per unit of integrated beam.

An estimate of the width of a single pulse of photons can be obtained from the measurement by unfolding the resolution function of the coincidence circuit. If Gaussian functions are assumed, then the r.m.s. value of the Gaussian function that represents the time variation of the intensity of the photon beam is found to be less than 1.5×10^{-9} seconds."

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