4. Observation of Cosmic Rays with Photographic Emulsions. (II)

Kiichi Kimura, Kazunori Yuasa, Ryutaro Ishiwari and *Senzo Tokunaga.*

We have been observing photographic emulsions (Eastman Kodak, NTB 8 sheets) exposed to cosmic rays on Mt. Norikura last summer, and the preliminary report was published at the meeting of I. C. R., October, 1949. In this report, more precise results on the cosmic ray stars and the mass of single tracks are discussed.

(i) Cosmic ray stars.

With careful observation of stars, we found that there were two sorts of stars. One of which is composed of stars whose branches are 20~40 microns, these cannot be distinguished from the stars caused by RdTh or Ra etc. The other is constituted from the stars clearly originated by cosnic rays. In this report, the natures of the former group are discussed. The main part of this group seems to be the stars of radioactive origin, but it is not yet determined how many of them are due to the the radioactive contaminations.

(ii) The mass determination of single tracks

To determine the mass of single tracks observed in the emulsions, we took at first the method of grain counting. We examined more than 40 single tracks, but the results are not precise enough to distinguish the small mass difference, because of the fading effect. Therefore we measured the scattering angles of the tracks by Coulomb's field for the mass determination. For one track which was distinguished as mu-meson by the grain counting method, the mass was estimated to be 211 m_e (m_e: mass of electron). This value is in good agreement with the other precise measurements. (For example Bishop estimated in 1949 as $215 \pm 4 m_e$ from $H\rho$ and range).

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5. The Efficiency of the Geiger-Müller Counter for the High Energy γ-Rays.

Masateru Sonoda.

In order to calculate the counting efficiency of a γ-ray counter, it is necessary to consider the effects of multiple scattering and bremsstrahlung of secondary electrons. The former effect was treated in the same way as given in the preceding paper[1]. As to the latter effect, a method similar to the cosmic ray shower theory was applied[2].

Now, if $n(E, x)$ is the number of the electrons of energy E produced by the multiplication process like the cosmic ray shower at the depth x distant from the point where the initial electron of energy E_0 is produced, the total probability of penetration $p_\gamma(E_0, x)$ with which the electron of initial energy E_0 can travel through thd distance x will be given by

$$p_\gamma(E_0, x) = \int^{E_0} n(E, x)\, dE$$

$n(E, x)$ can be obtained by solving the similar diffusion equation as in the shower theory. This, however, is a very difficult problem especially in the case of the intermediate energy under consideration and we were obliged to simplify the equation under some approximate assumption. The calculation was then performed numerically. The final results were shown in the table for the case of the lead counter of the inner diameter 2 cm.

Table

wall thickness in cm	energy of γ-ray quantum in mc^2				
	12	20	25	30	35
0.20	3.7%	9.7%	13.6%	16.0%	17.7%
0.30	3.5	10.4	15.2	19.1	22.4
0.40	3.4	10.2	15.0	19.8	24.4
0.50	3.2	9.7	14.4	19.6	24.7
0.60	3.1	9.0	13.8	18.8	24.4
0.65	3.0	8.7	13.5	18.3	23.9

1) M. SONODA, J. Phys. Soc. Jap. (in press).
2) B. ROSSI and K. GREISEN, Rev. Mod. Phys. **13**, 240 (1941)

6. Photo-disintegration of Beryllium by the High Energy γ-Rays.

Bunsaku Arakatsu, Masateru Sonda, Yoshiaki Uemura, Shinjiro Yasumi and *Yoshio Saji.*

The photo-disintergration of Beryllium was observed for the γ-rays of energy 17.6 and 6.13 Mev. These γ-rays were obtained by bombarding thick target of Li metal and CaF_2 with protons of energy of 500 Kev and 350 Kev, respectively. The proton beam was unseparated and the intensity was about 30~60 μA. Two proportional counters of methane flow type, were placed near the target, one of which was coated with thick layer of BeO and the other was uncoated. The Be-counter was 6 cm in diameter and 20 cm in length. After being amplified by the respective 4-stage