O pękach

Tadeusz Wibig

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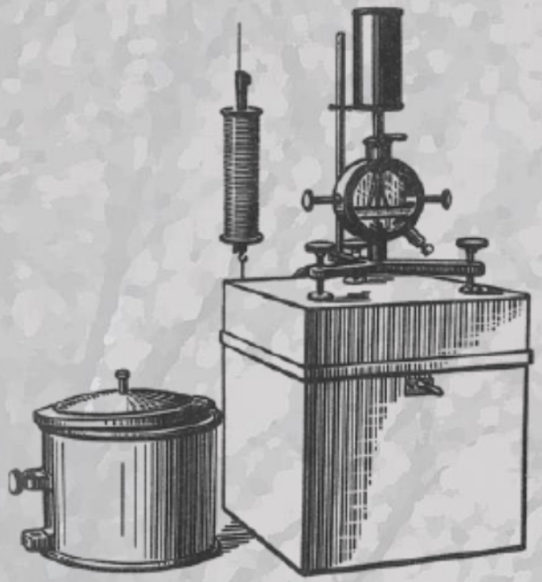
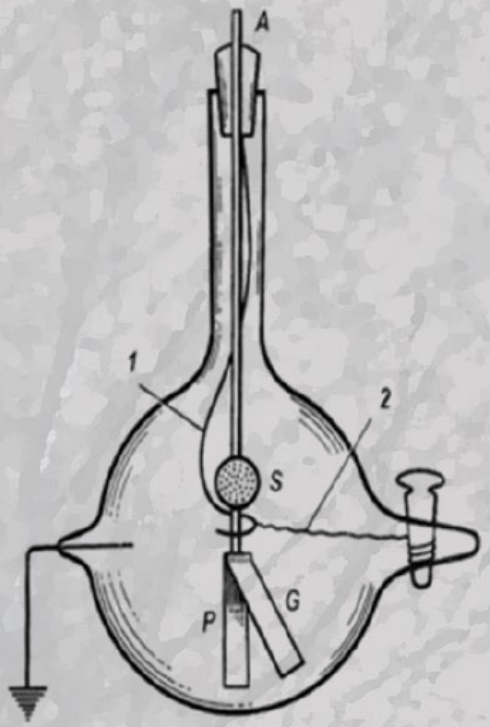
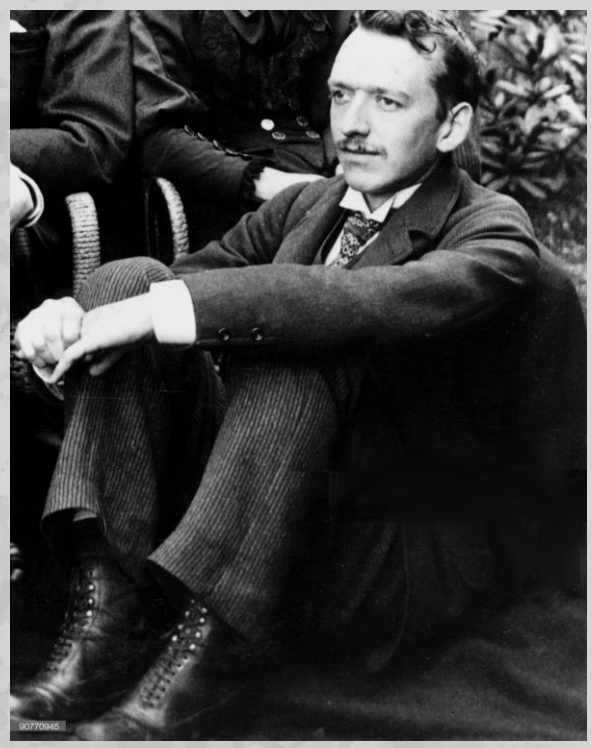
Wydział Fizyki i Informatyki Stosowanej
ul. Pomorska 149/153, 90-236 Łódź

CREDO
THE QUEST FOR THE UNEXPECTED

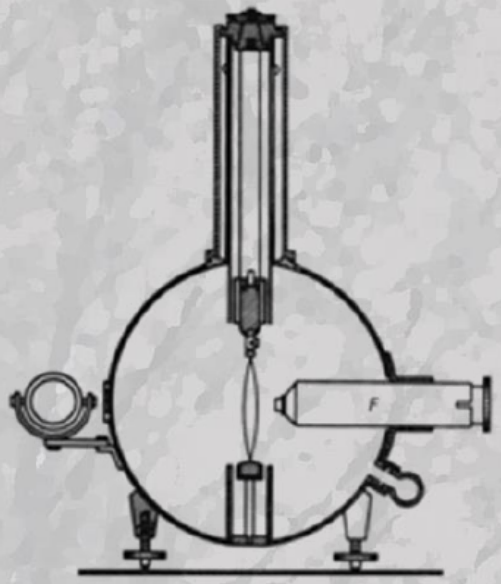


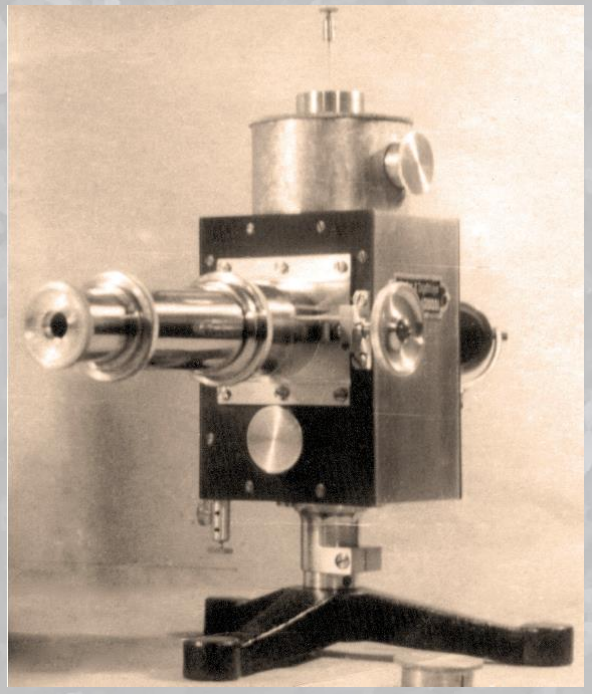
Elster & Geitel (1900)



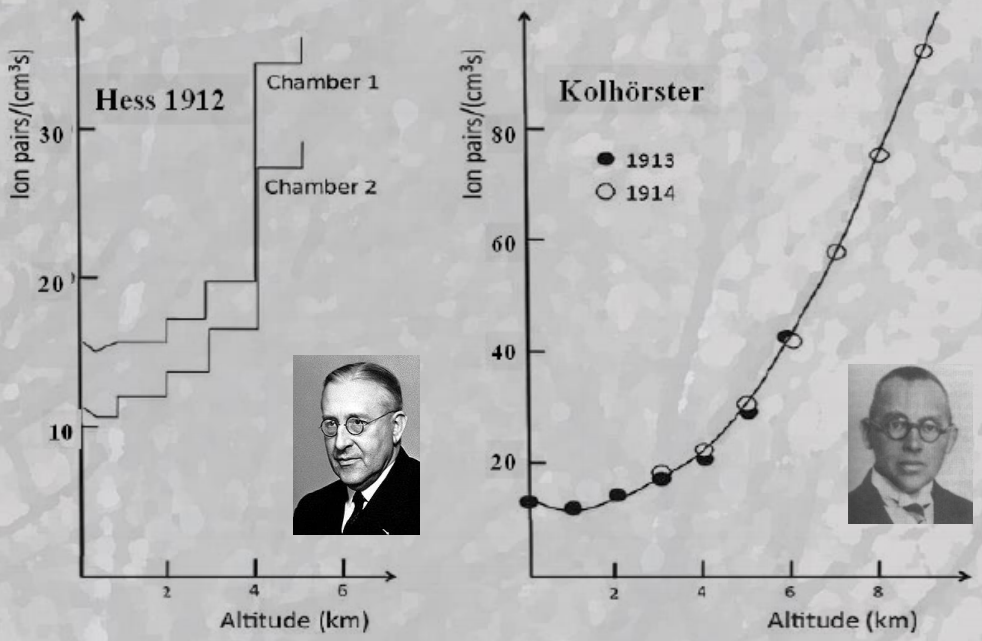


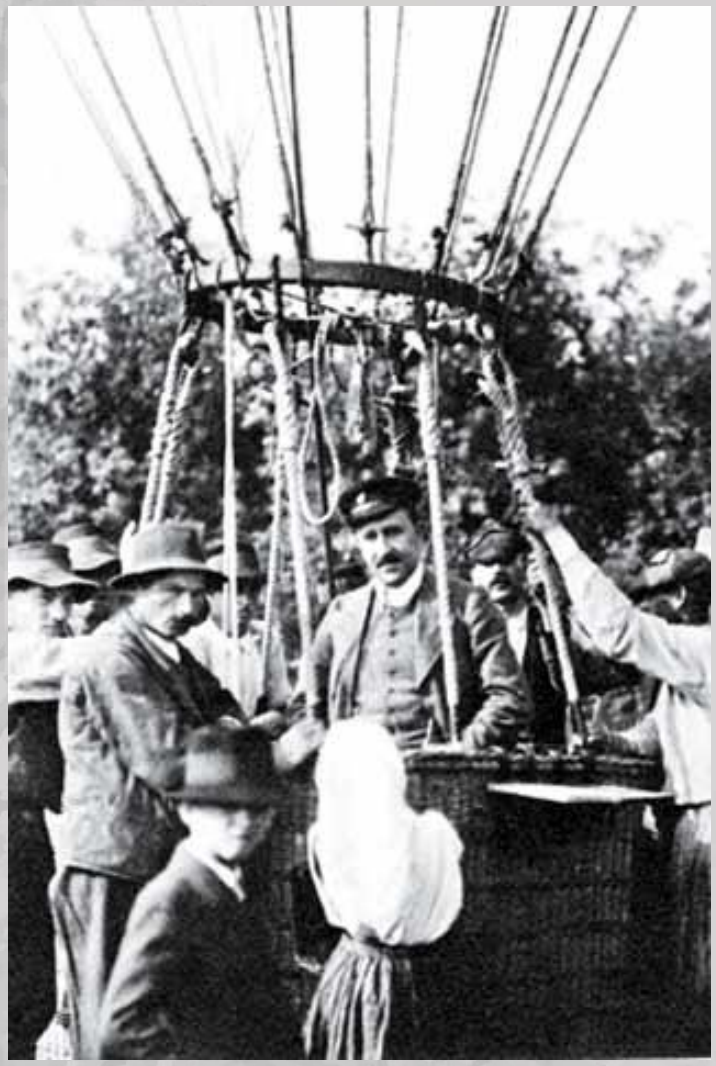
C.T.R. Wilson (1901)





T. Wulf (1909)


Hess 1912
Chamber 1
Chamber 2
Ion pairs/(cm³s)
30
20
10
2
4
6
Altitude (km)
Kolhörster
1913
1914
Ion pairs/(cm³s)
80
60
40
20
2
4
6
8
Altitude (km)



Hess (1912)

PROCEEDINGS OF

THE ROYAL SOCIETY.

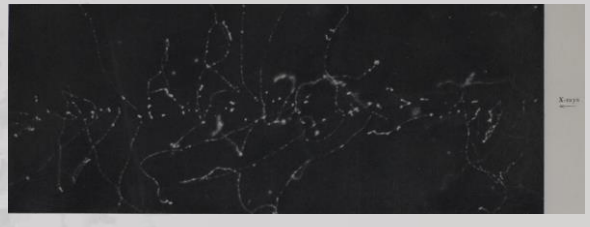
Section A.—Mathematical and Physical Sciences.

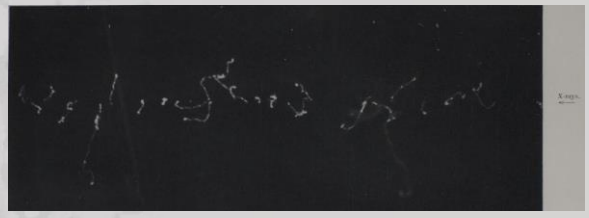
Investigations on X-Rays and β-Rays by the Cloud Method. Part I.—X-Rays.

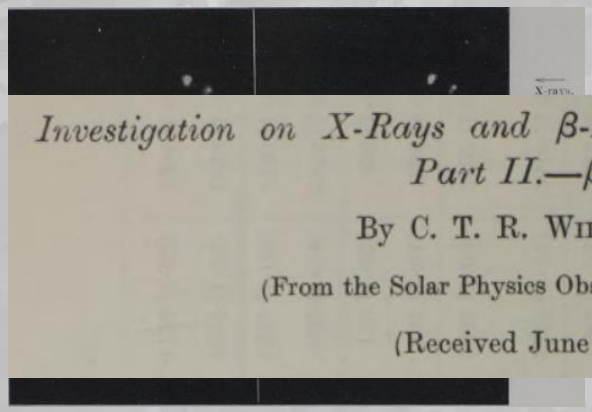
By C. T. R. Wilson, F.R.S.

(Received June 23, 1923.)

(From the Solar Physics Observatory, Cambridge.)





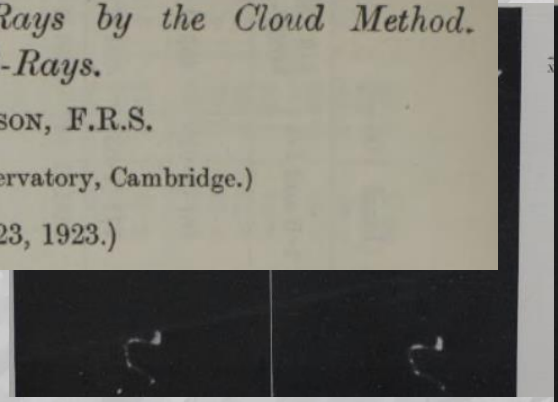


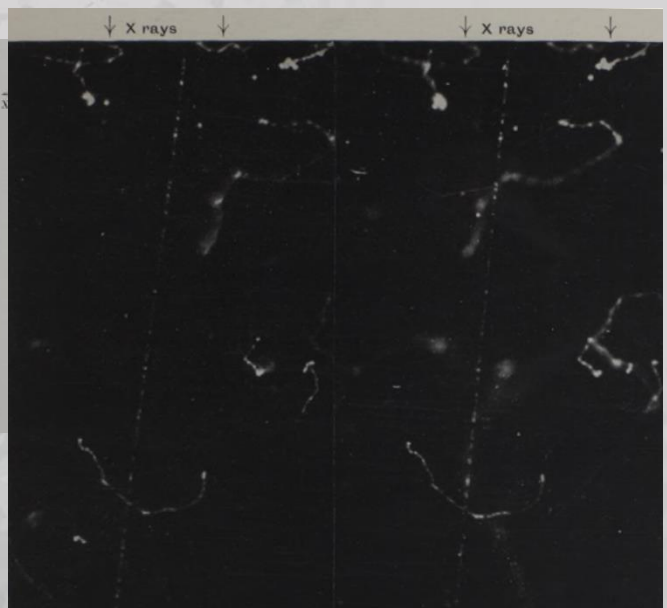
Investigation on X-Rays and β-Rays by the Cloud Method. Part II.—β-Rays.

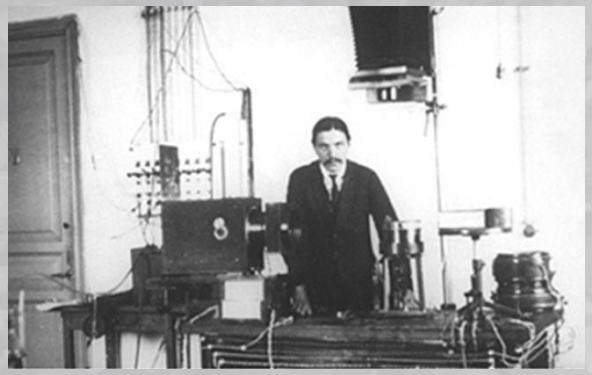
By C. T. R. Wilson, F.R.S.

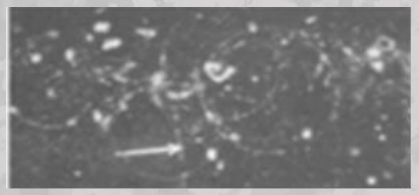
(From the Solar Physics Observatory, Cambridge.)

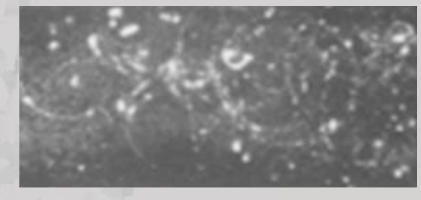
(Received June 23, 1923.)

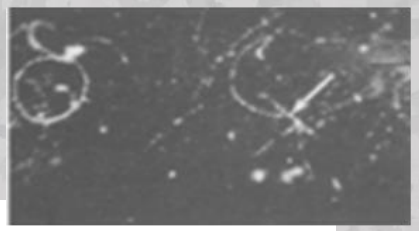


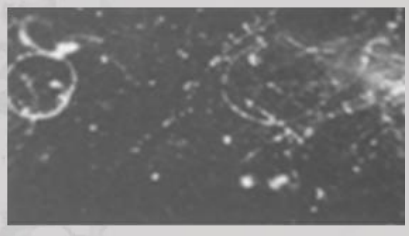








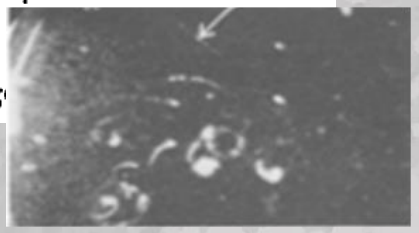


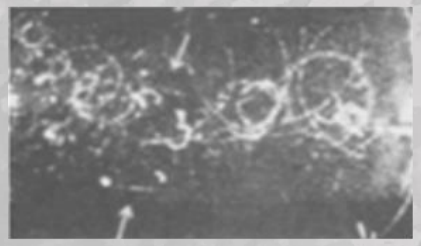


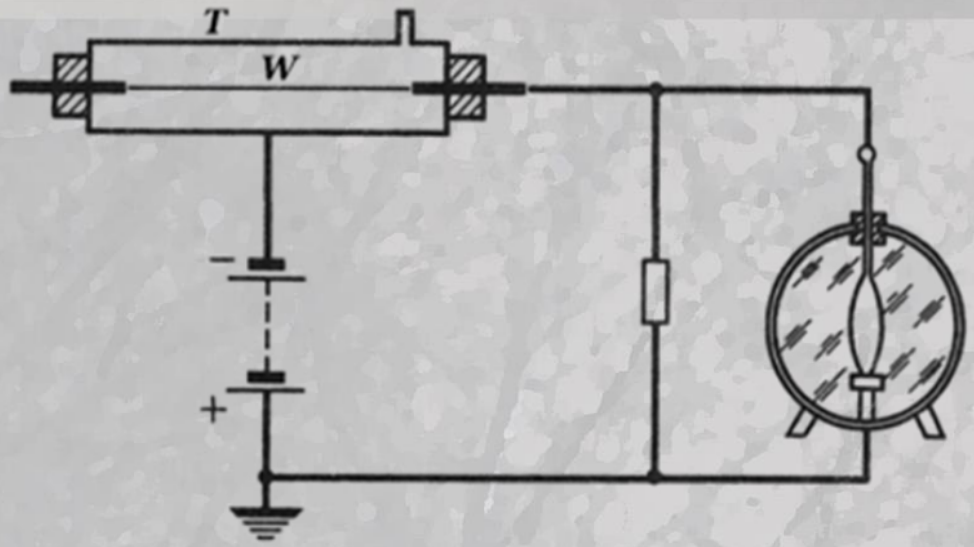
Über eine neue Art sehr schneller β-Strahlen.

Von **D. Skobelzyn** in Leningrad.

Mit 9 Abbildungen im Text und auf einer Tafel. (Eingegang





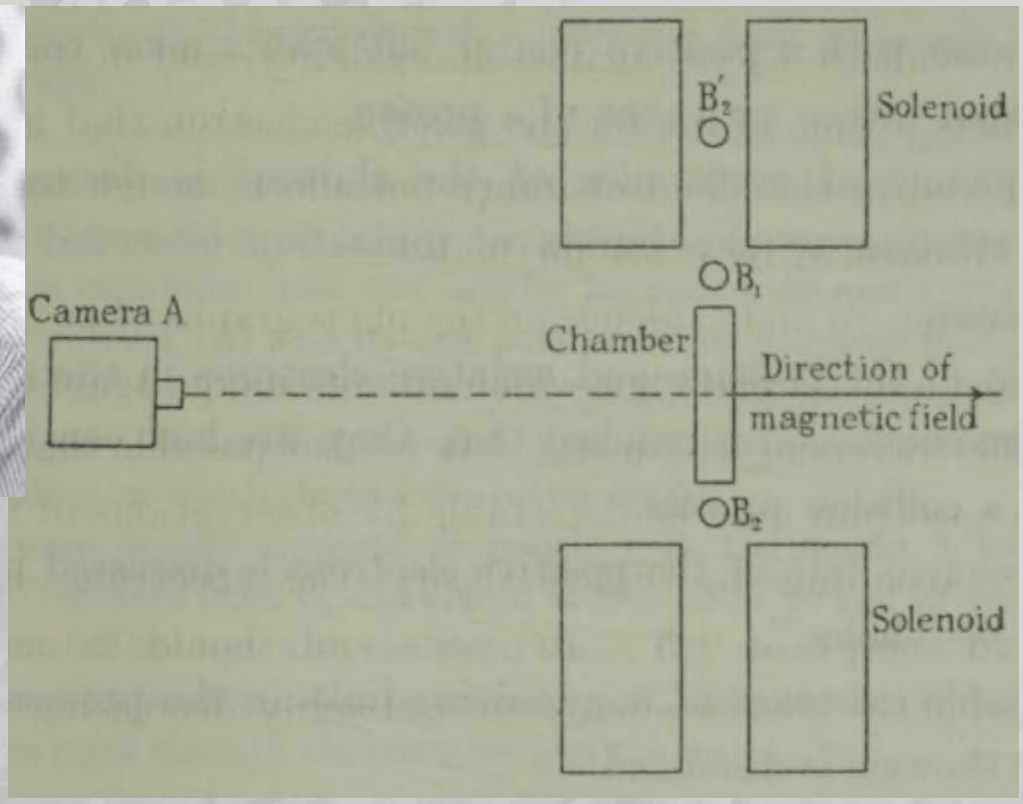


Geiger & Muller (1928)

Some Photographs of the Tracks of Penetrating Radiation.

By P. M. S. Blackett and G. P. S. Occhialini, The Cavendish Laboratory, Cambridge University.

(Communicated by Lord Rutherford, O.M., F.R.S.—Received February 7, 1933.)



It is of interest to make a rough estimate of the frequency of these showers in relation to the number of nuclei in the surrounding material. One coincidence occurs every 2 minutes, and one shower with more than 8 tracks about every thirty coincidences; that is, once every hour. These come predominantly from the part of the copper solenoid above the chamber, say, from a mass of 10 kg. of copper. Taking the chance to be 1 in 5 that a shower which has originated in this copper will set off the counters we get that one shower originates in 10 kg. of copper about every 10 minutes. Expressed in the form of a mean life one finds a value of about 10^{18} years.

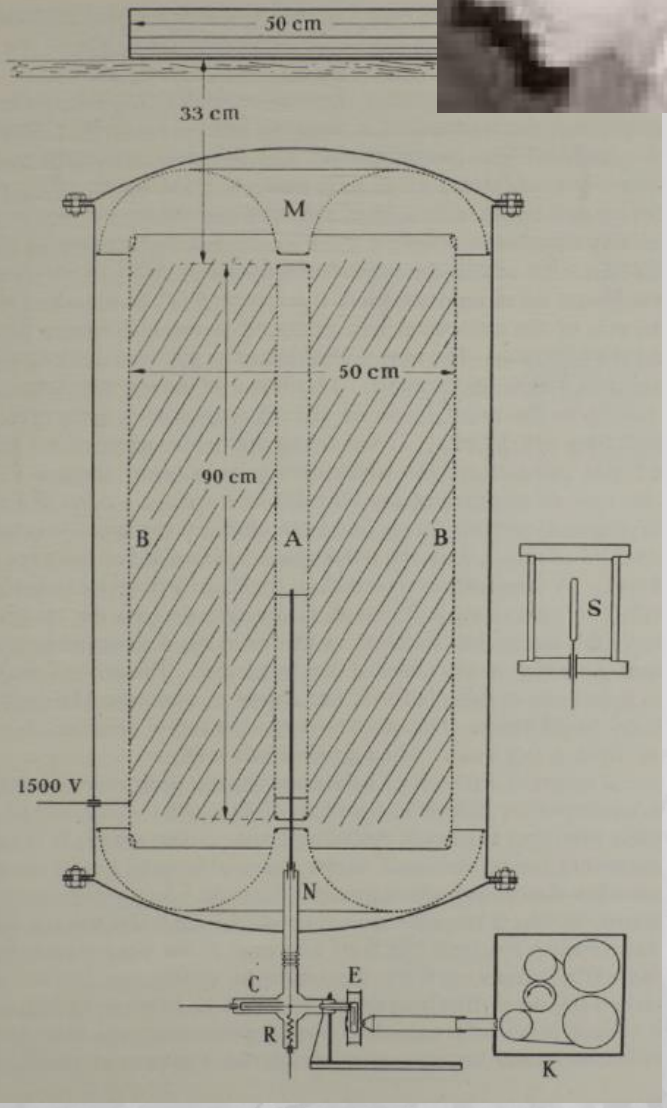
The Nature of Large Cosmic-Ray Bursts

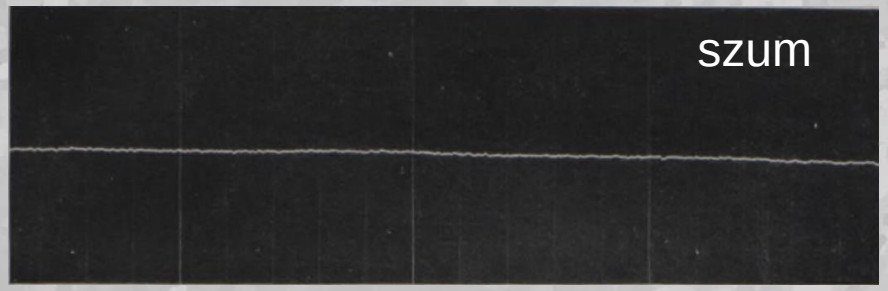
By HUGH CARMICHAEL, B.Sc., Edin., Clerk Maxwell Student, University of Cambridge

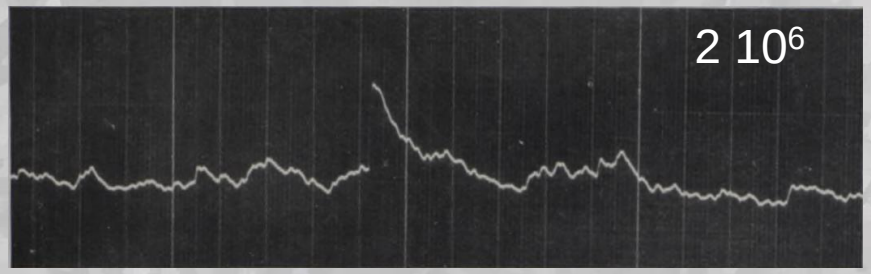
(*Communicated by Lord Rutherford, O.M., F.R.S.—Received N* 1935)

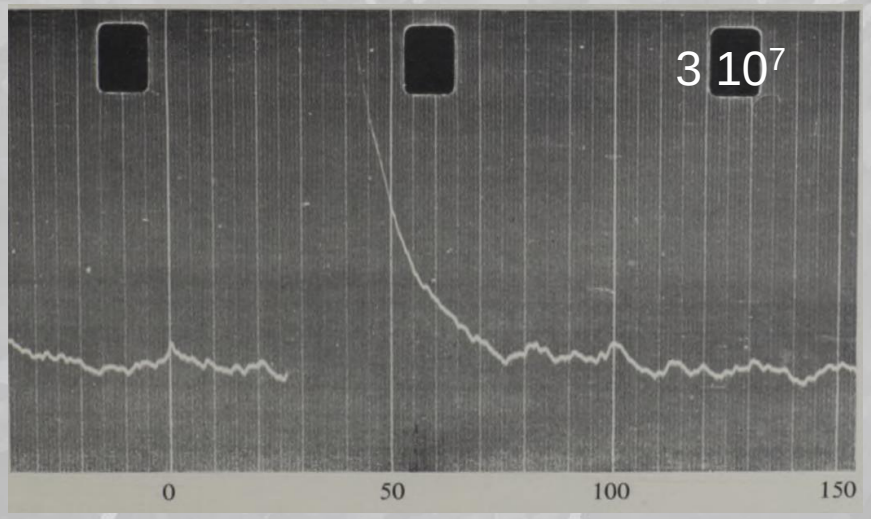
Number of bursts in a range of size of 0·1 mm

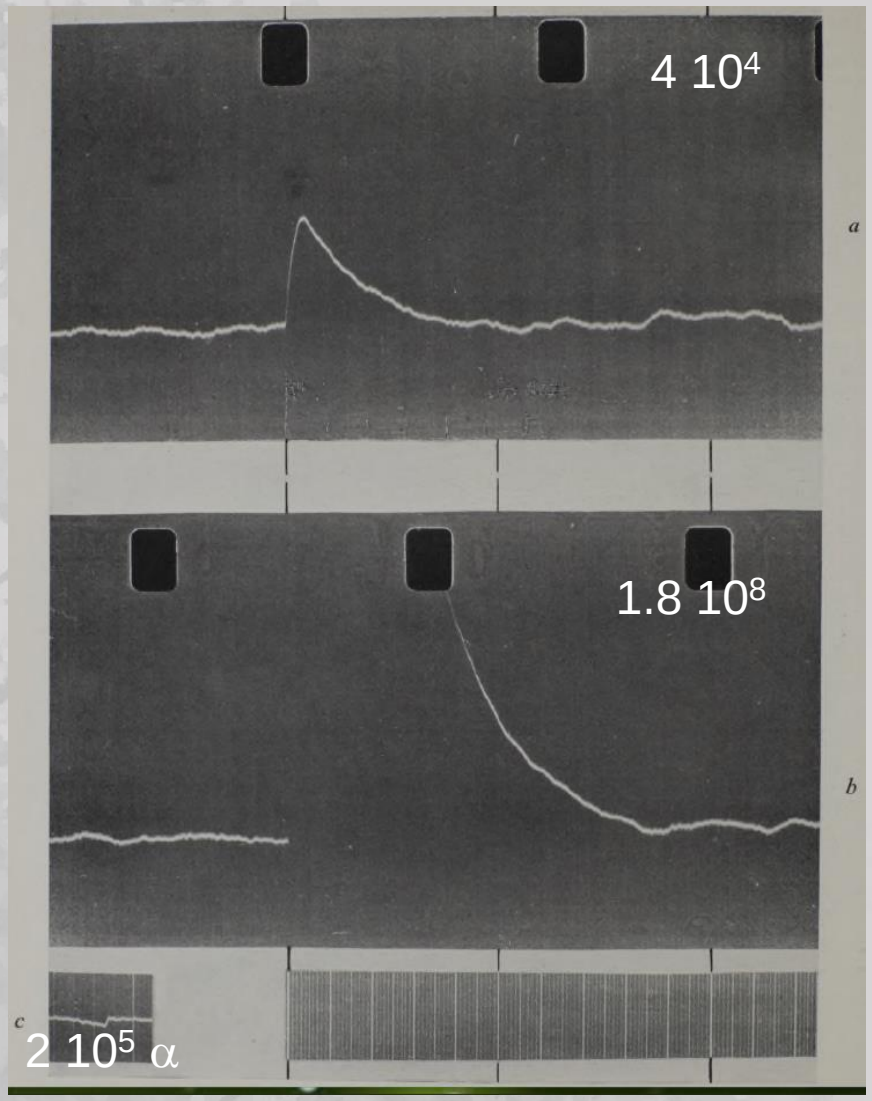
Size of bursts 0·1 mm units	Electrometer sensitivity = 100 mm/V					Electrometer sensitivity = 200 mm/V		
	Argon pressure = 115·5 cm Hg					Nitrogen 77·5 cm Hg		H_2 185 cm
	0 cm Pb	0·76 cm	1·52 cm	4·3 cm	7·9 cm	0 cm	4·3 cm	4·3 cm
	315¼ hr	215 hr	229¾ hr	219 hr	200 hr	97¾ hr	163½ hr	151 hr
4–5				197‡		167♂	433♀	
5–6	327	141*	231	223	379†	48♂	140♀	173
6–7	141	61*	117	90	144†	126	185	50
7–8	84	65	62	60	67†	38	63	11
8–9	28	34	32	32	32	15	30	1
9–10	23	20	24	20	17	8	13	2
10–11	18	7	16	17	11	3	7	2
11–12	10	8	11	10	7	1	8	
12–13	6	7	9	8	6	3	4	1
13–14	3	4	6	5	2	1	1	
14–15	2	3	7	6	1	2	4	
15–16	4	2	4	4	1	1	2	
16–17	2	3	2	1	2		1	
17–18			2	2			3	2
18–19	3	2	2	2	1		2	2
19–20	1	1	1		1	1	1	
20–21	1		1	2	1		1	
21–22	2		1	1				1
22–23	1		3	3				
23–24	2	1	1	1			1	
24–25	1		1	3			1	
25–26				1			1	
26–27	1		2					
27–28	1	2						
28–29								
29–30	1		1	1		1		
30–31	1		1					
Larger sizes, actual size given	34	31, 31	33, 33	31	33	32	3	
	37	32	36	32	40		32	
	39	33	44	33	42		37	
	46	41	60	36	105		38, 38	
	64	42	73	56	150		42	
	70	45, 45	96	73			47	
	120	70		87			73	
	125							







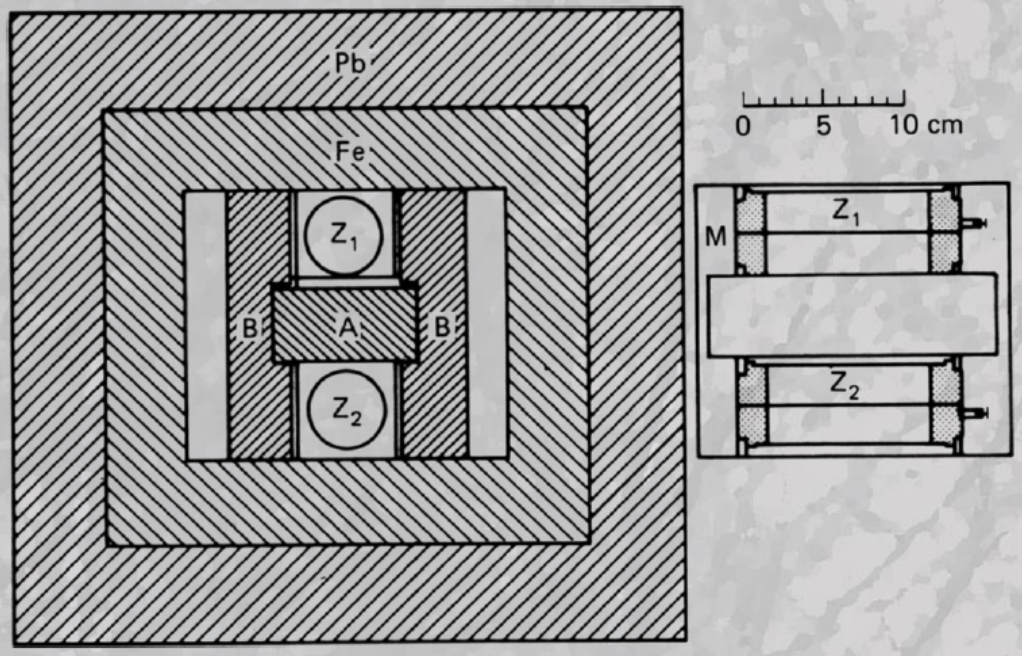


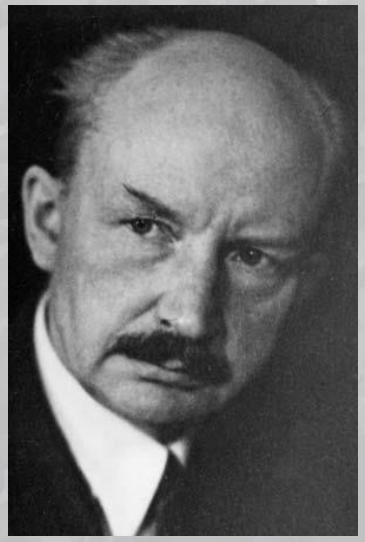


(a) Burst of 4×10^6 ion-pairs in A in small chamber.
(b) Burst of $1{\cdot}8 \times 10^8$ ion-pairs in A small chamber.
(c) Calibration kick of 2×10^5 ion-pairs equal to ionization of a single long-range α-particle. Compare (c) and (b) !

(Enlarged × 5 from 16 mm ciné camera film.)

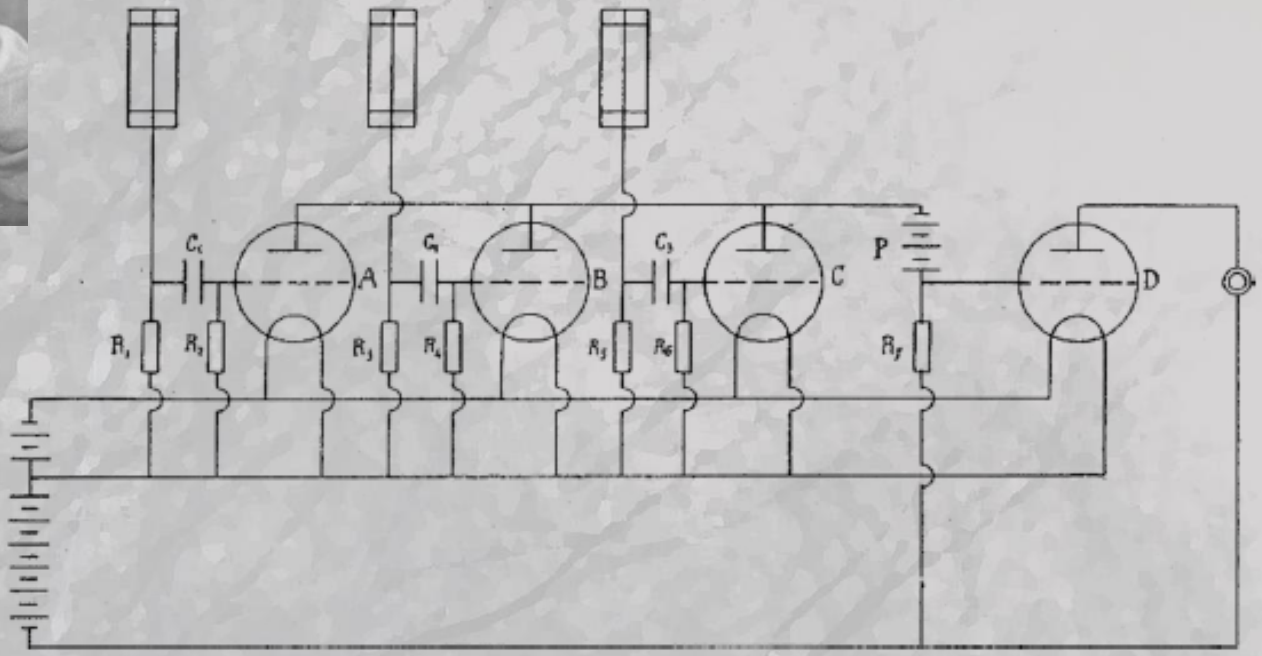
(Kick (c) has been turned upside-down by mistake.)

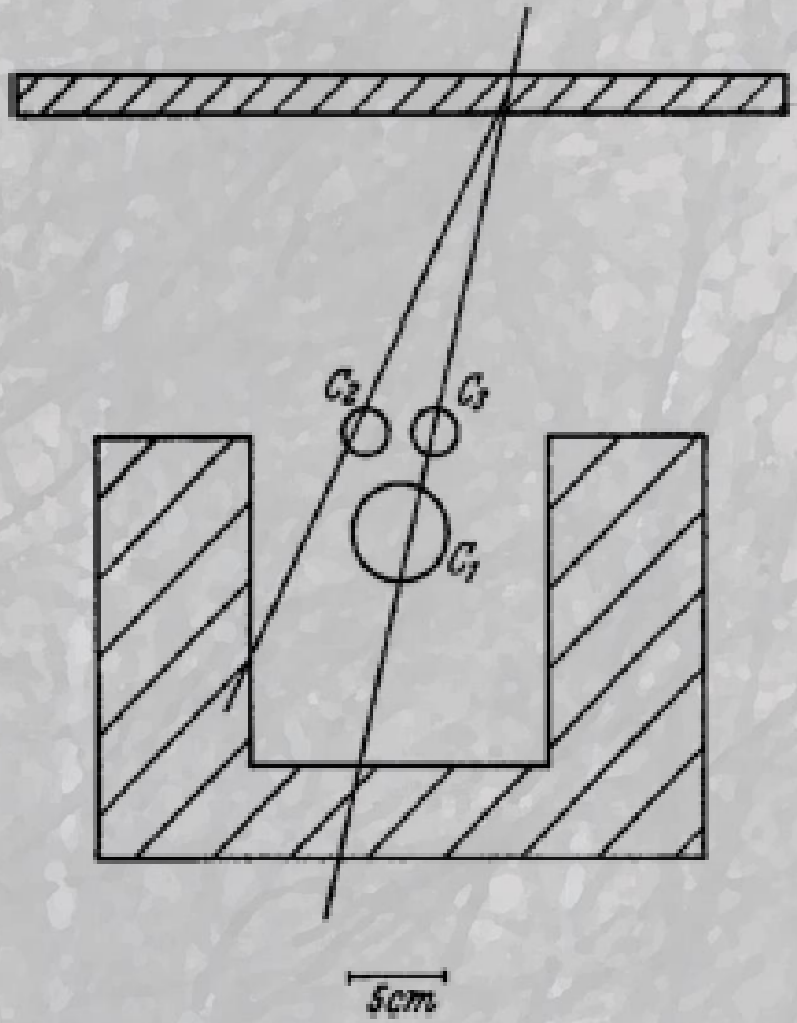


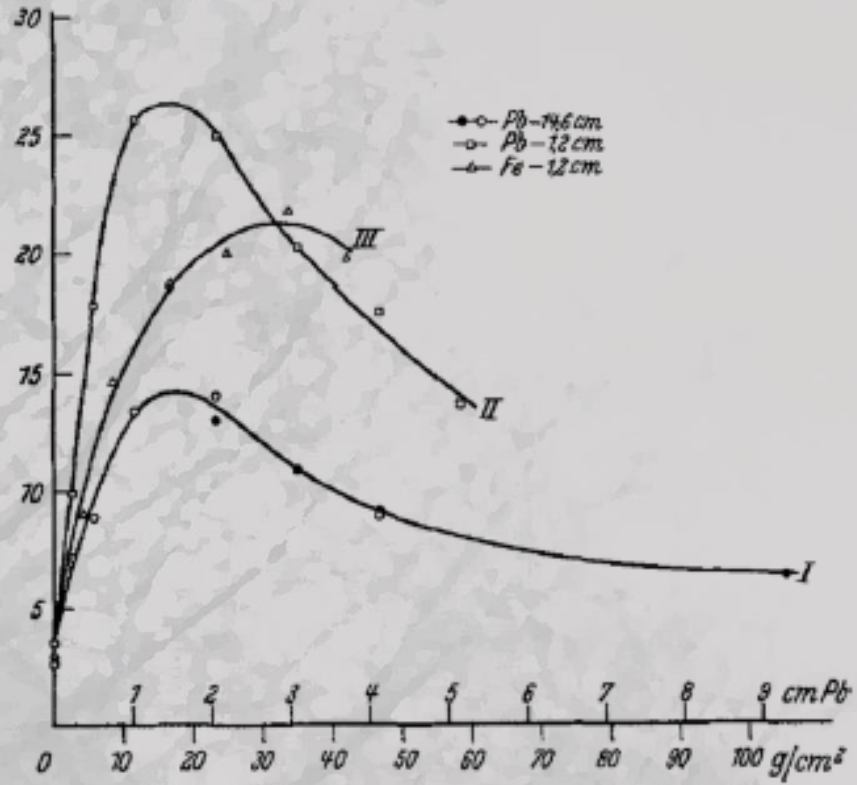


Bothe & Kolhörster (1929)

Rossi (1932)

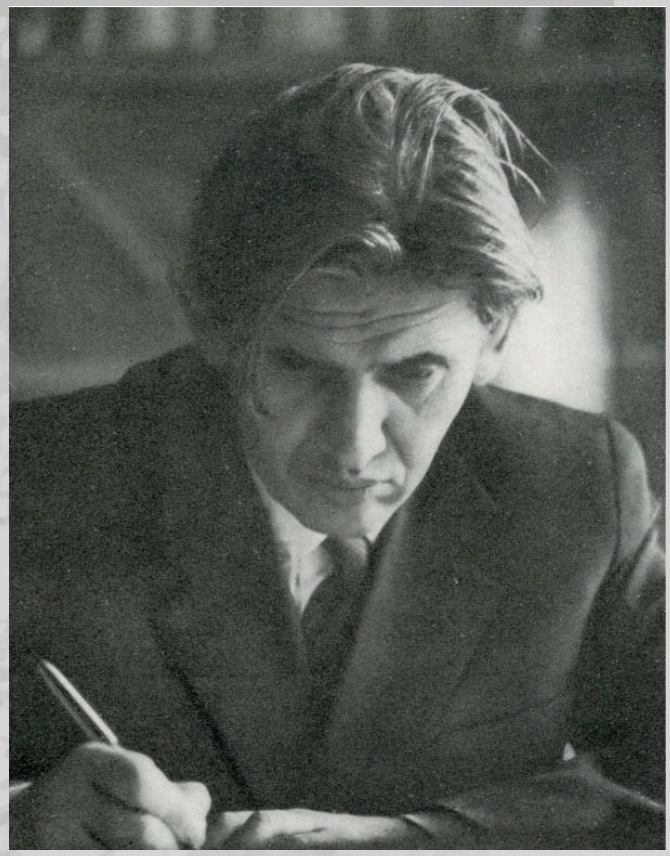


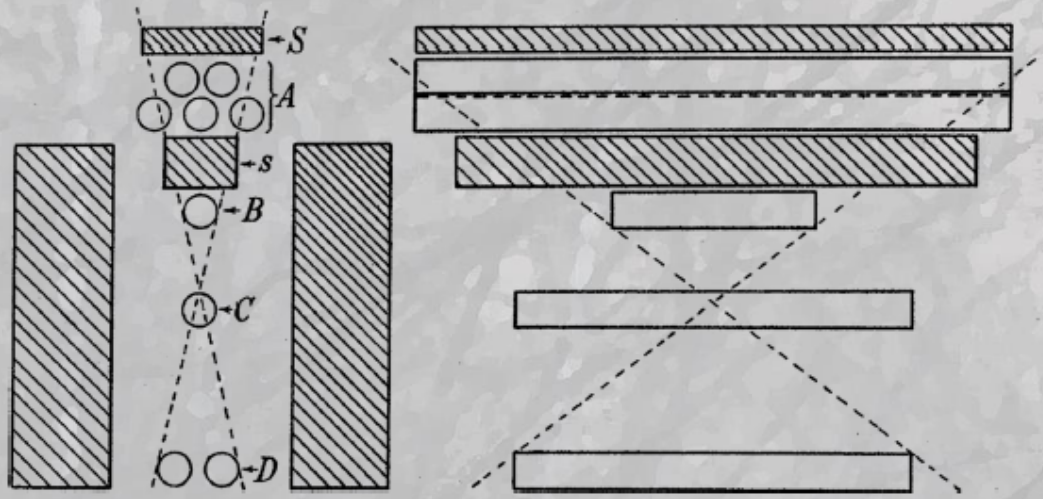

C2
C3
C1
5cm

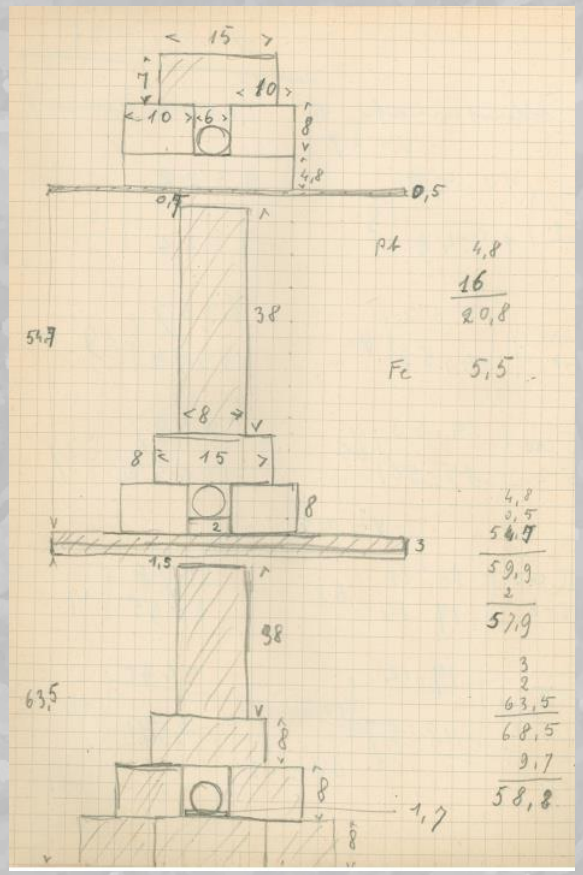

Pb – 14,6 cm
Pb – 12 cm
Fe – 12 cm
I
II
III
30
25
20
15
10
5
0
1
2
3
4
5
6
7
8
9 cm Pb
10
20
30
40
50
60
70
80
90
100 g/cm²

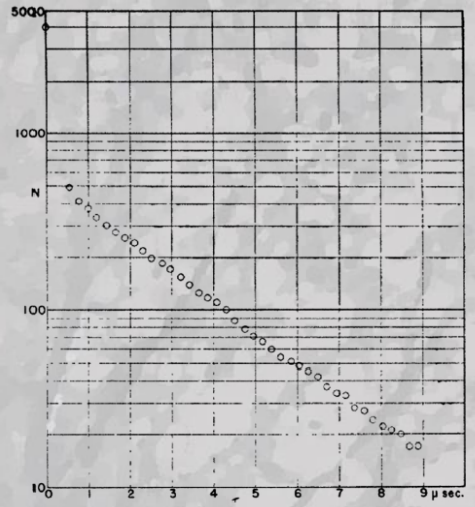
Rossi (1933)

Janossy & Rossi (1933)

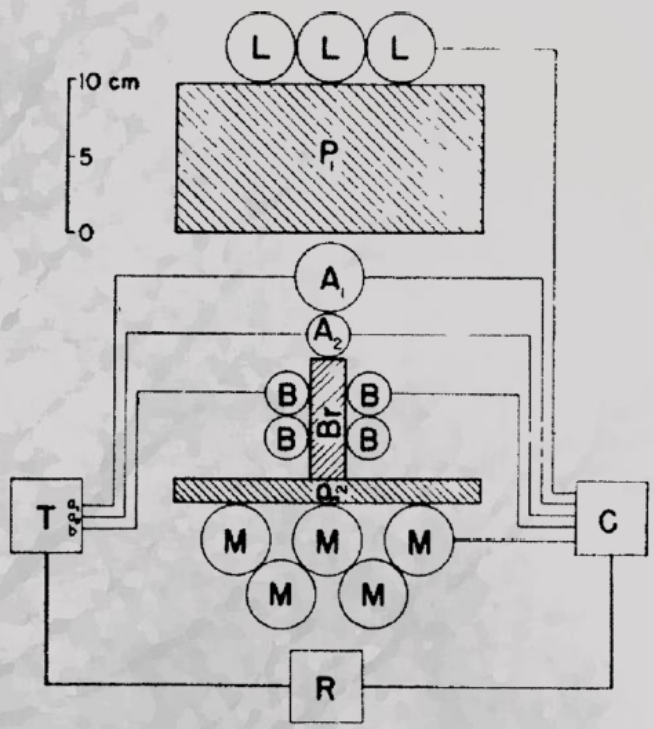








Rossi (1932)



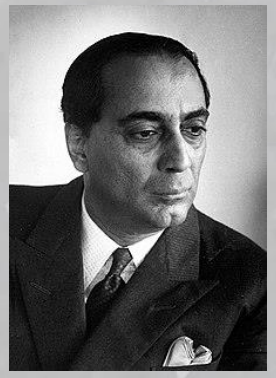
Rossi & Nereson (1942)

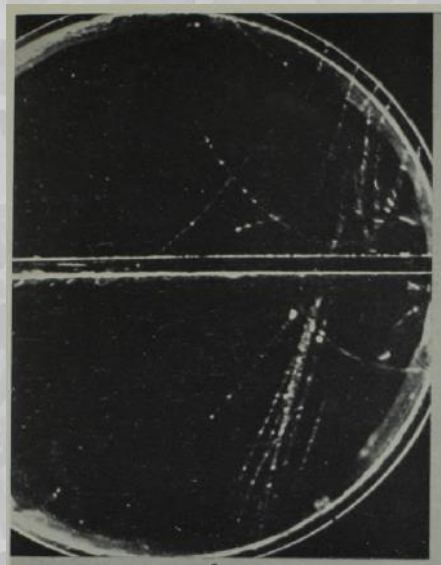
The Passage of Fast Electrons and the Theory of Cosmic Showers

By H. J. Bhabha, *Gonville and Caius College, Cambridge*
and W. Heitler, *Wills Physical Laboratory, University of Bristol*

(*Communicated by N. F. Mott, F.R.S.—Received* 11 *December* 1936)

* The idea that cosmic ray showers could be explained in this way had already been expressed in 1934 by L. Nordheim in a conversation with one of us (H.), but owing to the ill-founded suspicion in which the theory was then held, it did not seem worth while carrying out any calculations. Mr Carmichael had also pointed out in a conversation with one of us (B.) that one could explain the showers by successive processes of multiplication.





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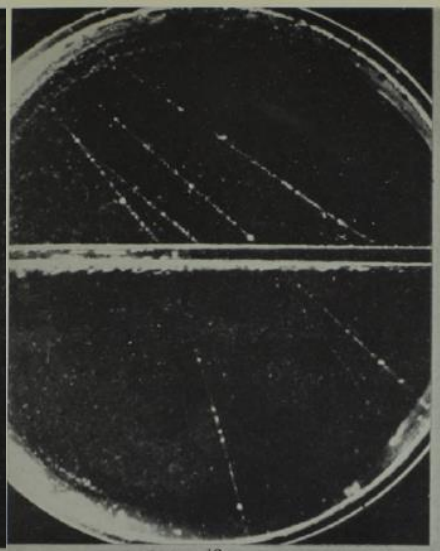

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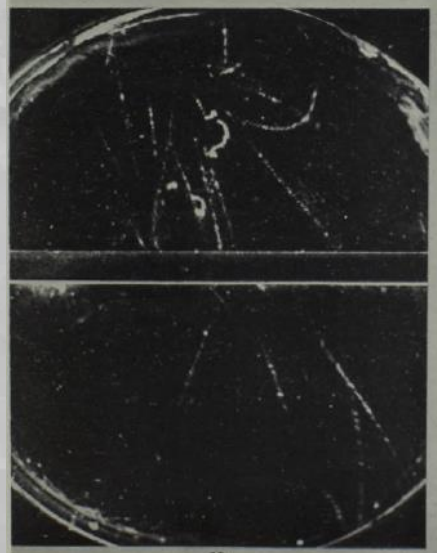

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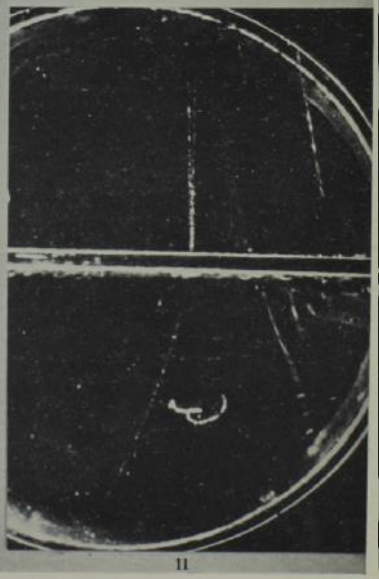
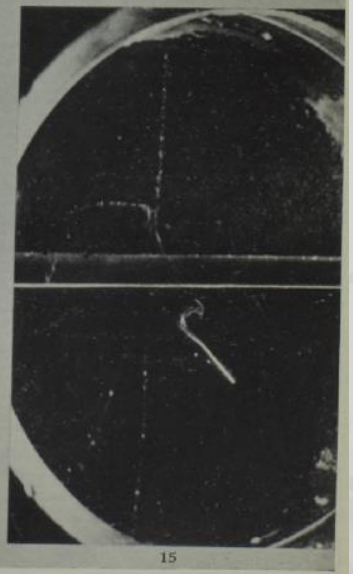


11

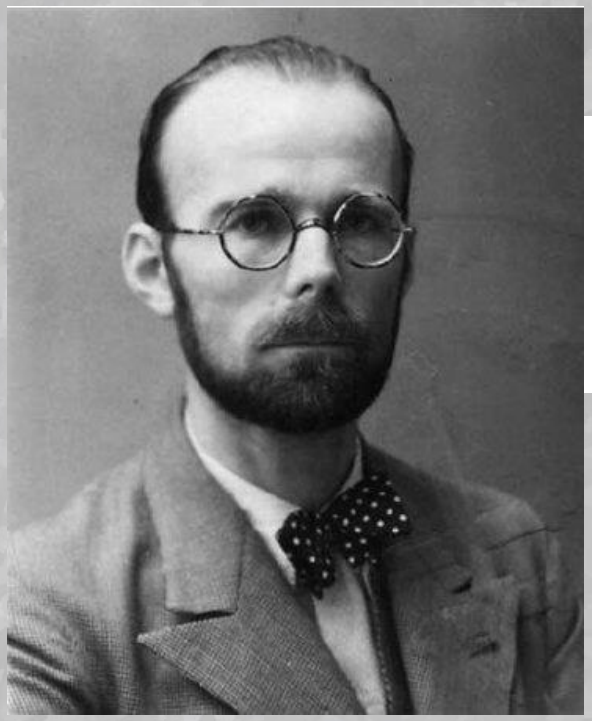
14



15

(Facing p. 724.)

(Facing p. 726.)



ACADÉMIE DES SCIENCES - SÉANCE DU 8 JUIN 1938

PHYSIQUE NUCLÉAIRE.- *Grandes gerbes cosmiques atmosphériques contenant des corpuscules ultra-pénétrantes.* Note de MM. **PIERRE AUGER, ROLAND MAZE** et Mme **THÉRÈSE GRIVET-MEYER**, présentée par M.Jean Perrin.

	1ère partie			2ème partie		3ème partie			
Nombre de compteurs	3	3	3	2	3	2	2	2	2
Distance extrême en mètres	0,20	2	5	1,3	1,3	2	2	2	2
Ecran de plomb (cm)	-	-	-	-	-	0	5	10	15
Coïncidences par heure (fortuites déduites)	6,7	2,1	0,7	3,4	1,5	4	0,7	0,5	<0,2

ACADÉMIE DES SCIENCES - SÉANCE DU 18 JUILLET 1938

PHYSIQUE NUCLÉAIRE.- *Les grandes gerbes cosmiques de l'atmosphère.* Note[1] de MM. **PIERRE AUGER** et **ROLAND MAZE**, présentée par M. Jean Perrin.

	3 compteurs				4 compteurs	Δ
d	$E = 0,2$	5	10	15		
2 m	1,7	0,86	0,2	<0,1	0,8	40
5 m	1,4	0,7	-	-	-	-
20 m	0,9	0,4	0,1	<0,1	0,45	30

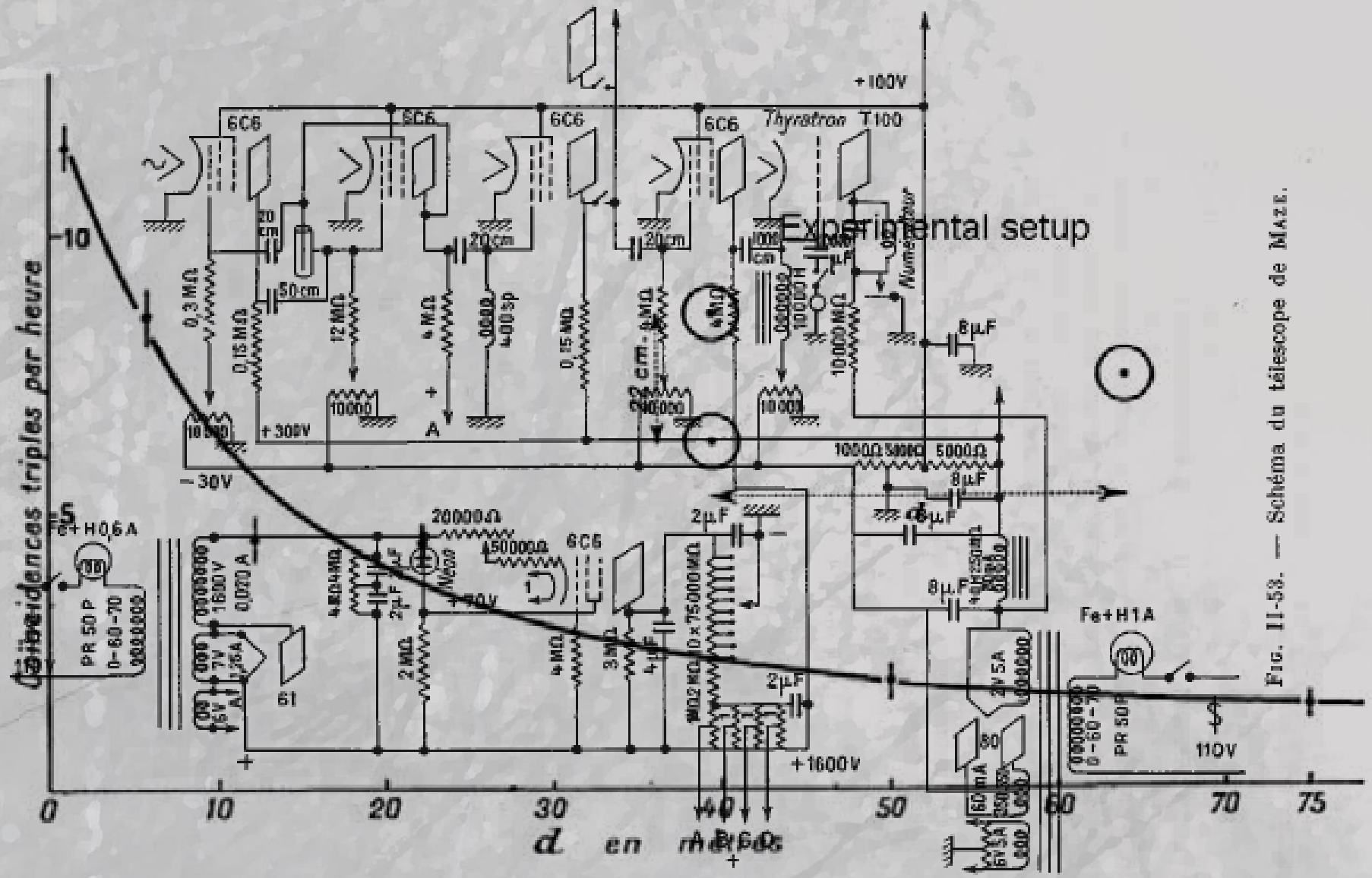
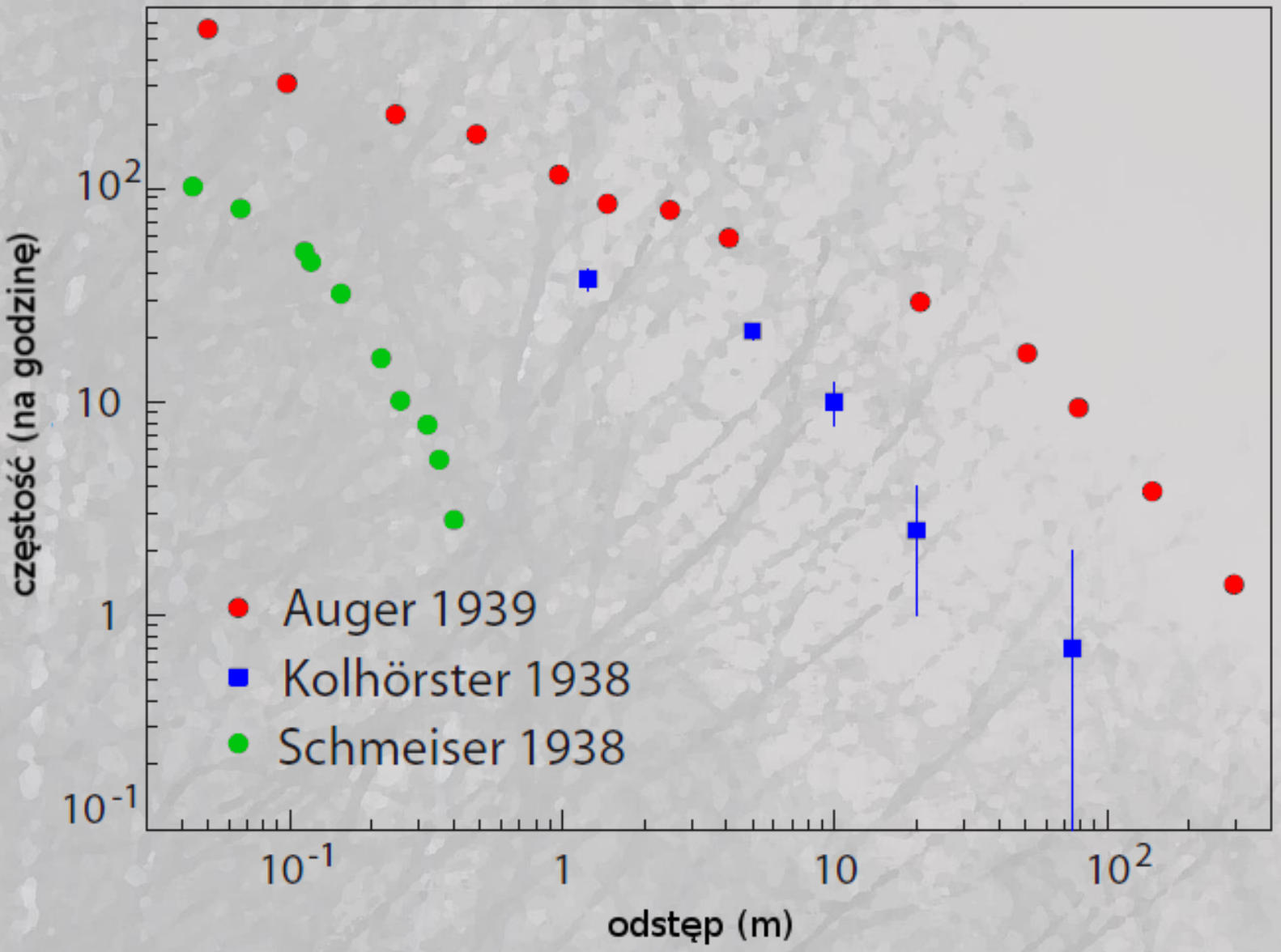
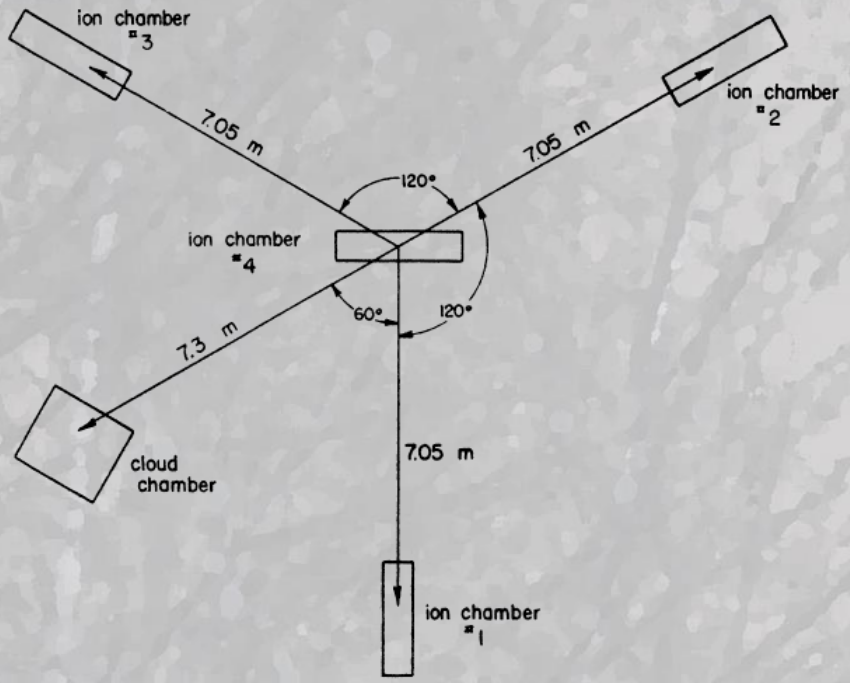
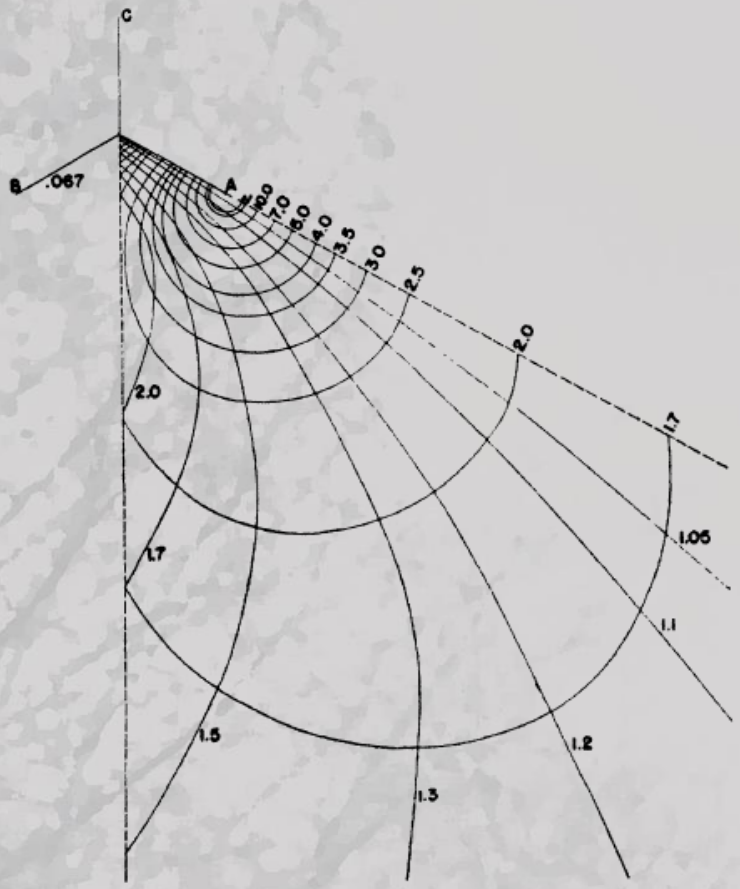


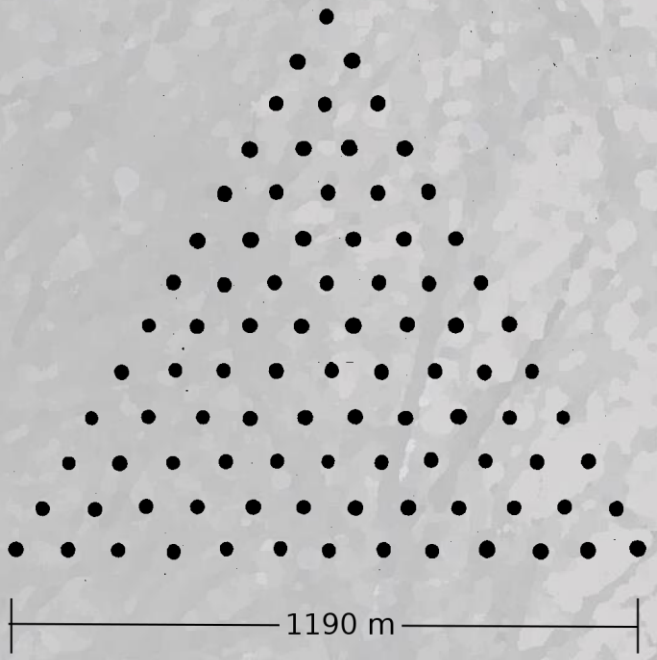
Fig. II-53. — Schéma du télescope de Maze.

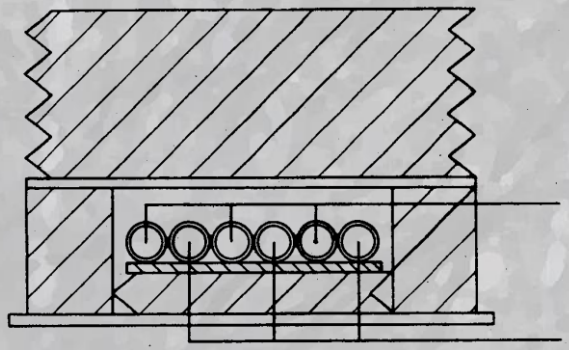

częstość (na godzinę)
10^2
10
1
10^{-1}
Auger 1939
Kolhörster 1938
Schmeiser 1938
10^{-1}
1
10
10^2
odstęp (m)



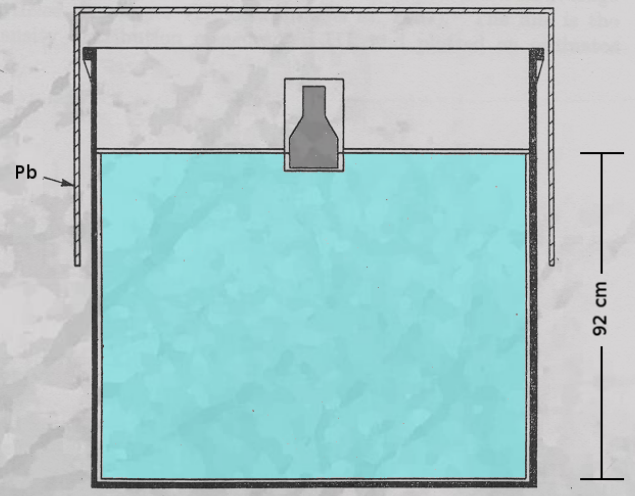


Echo Lake, CO.
Wiliams - lokalizacja osi pęku (1948)

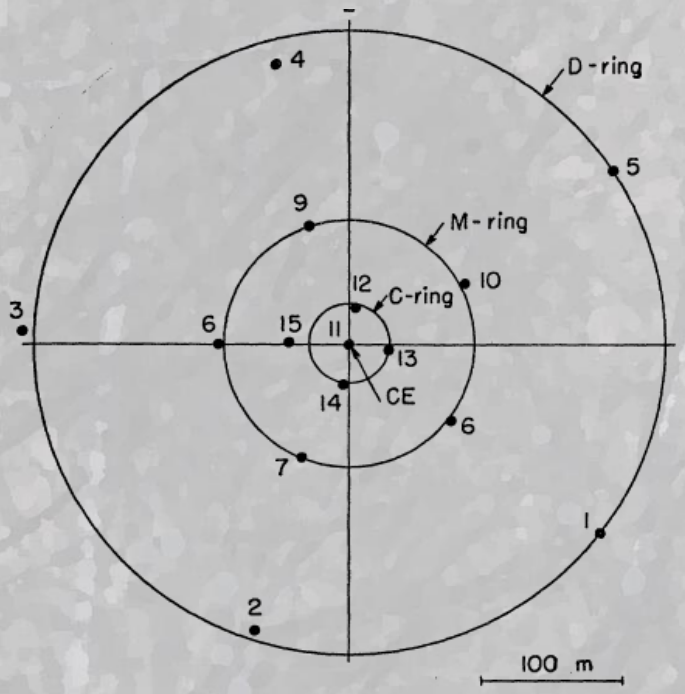


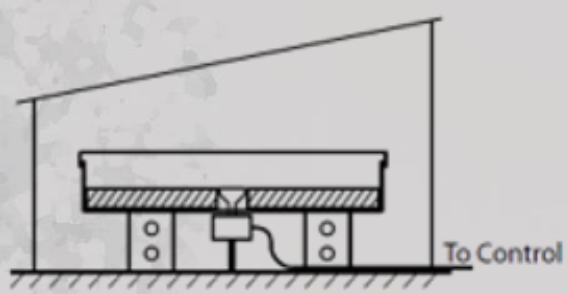


Harwell, UK. (1950-60)



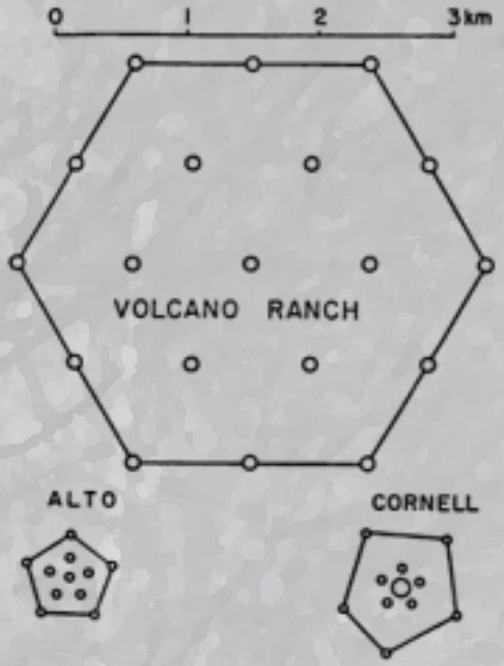
(1958)



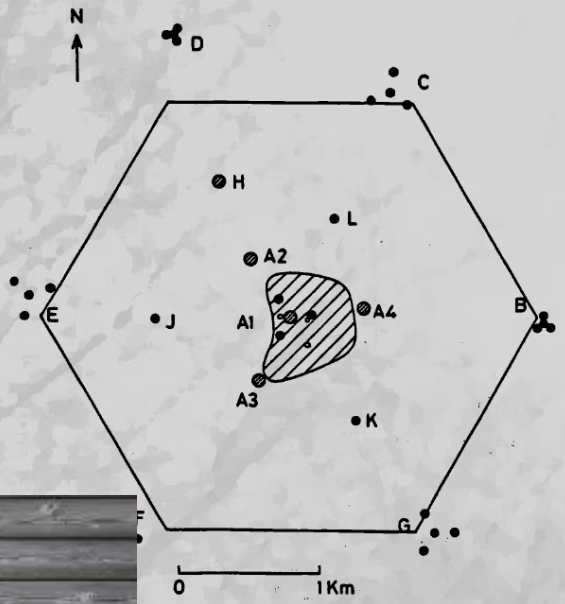


MIT Agassiz (1957)

Największy pęk zarejestrowany 3 10^{18} eV

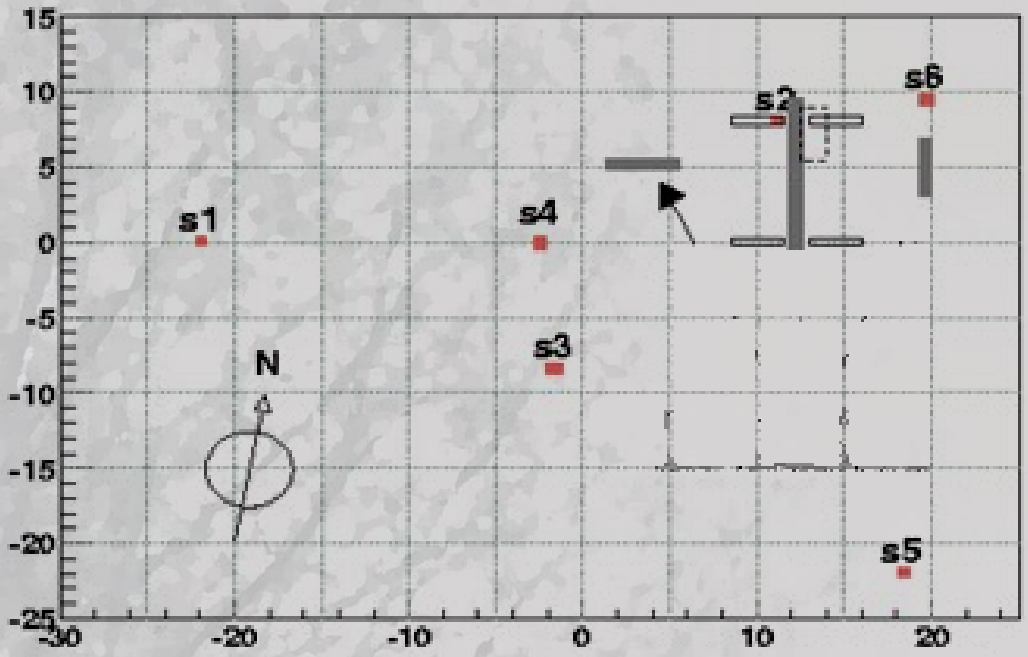


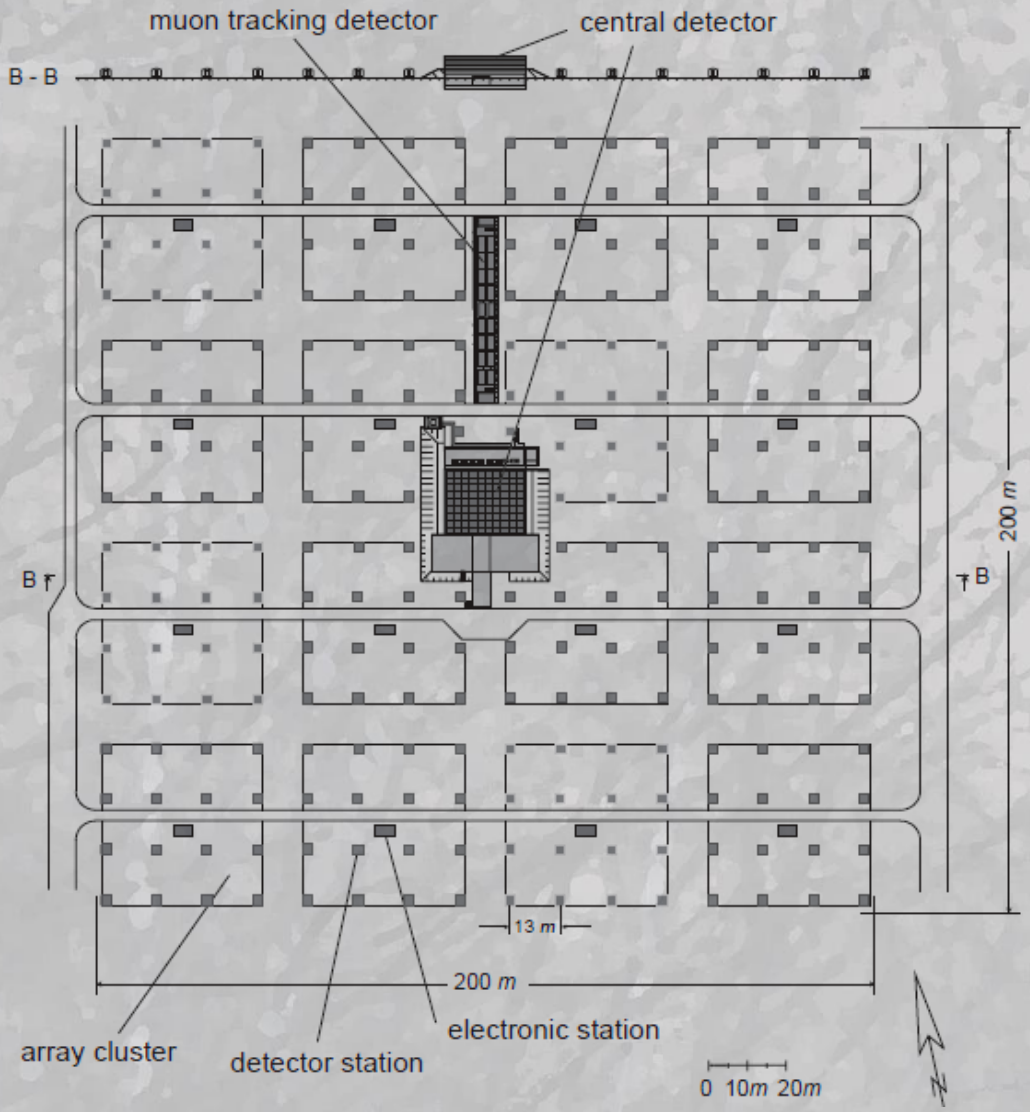
Volcano Ranch (1960-1984)



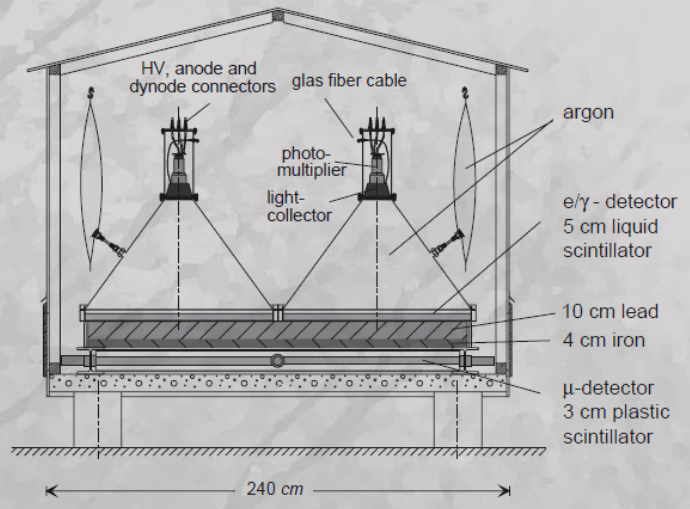
Haverah Park (1962-1980)

Łódź (~1960-2000)

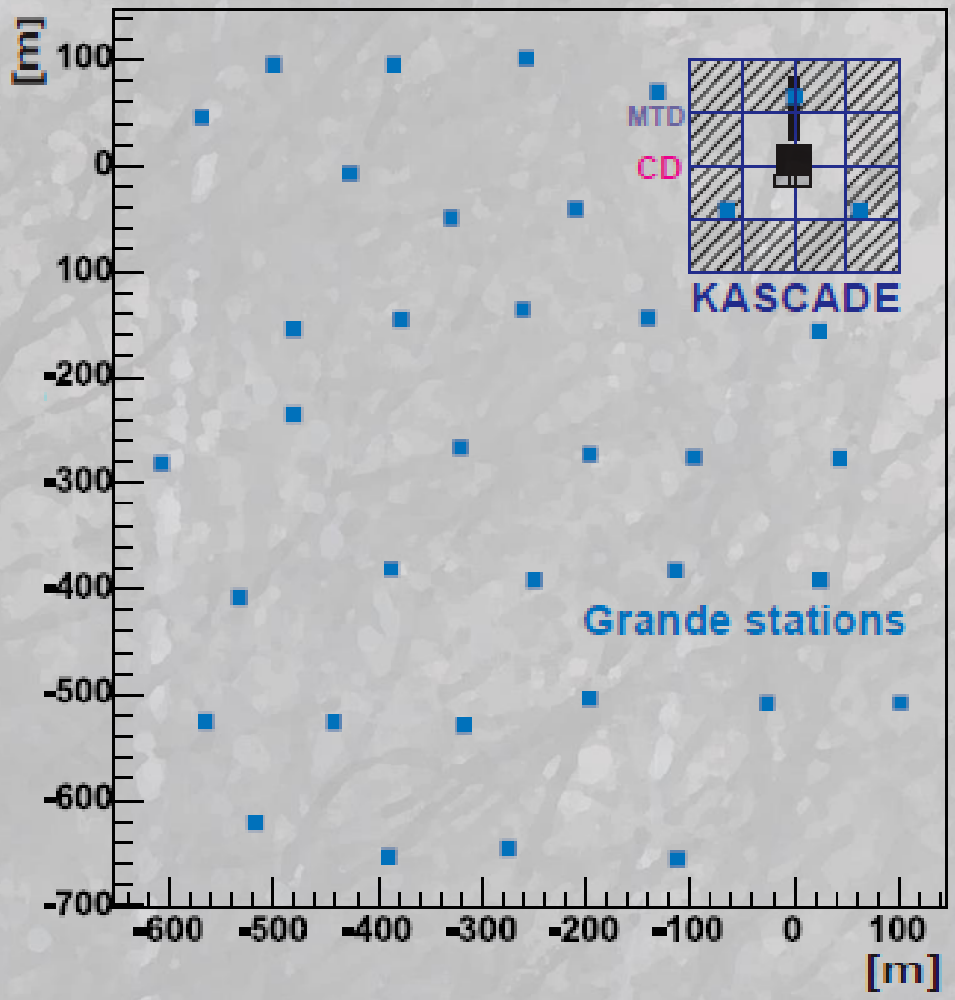


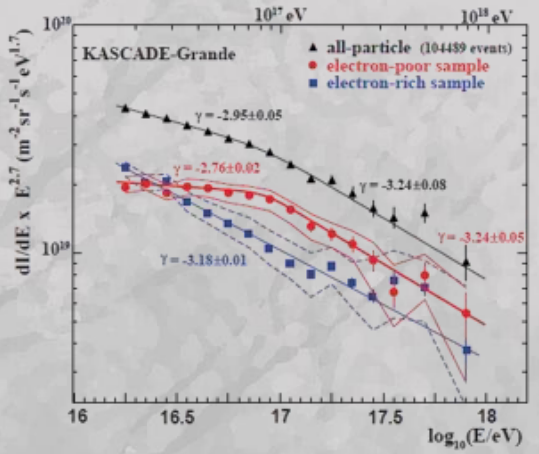


KASCADE (2000 - 2013)

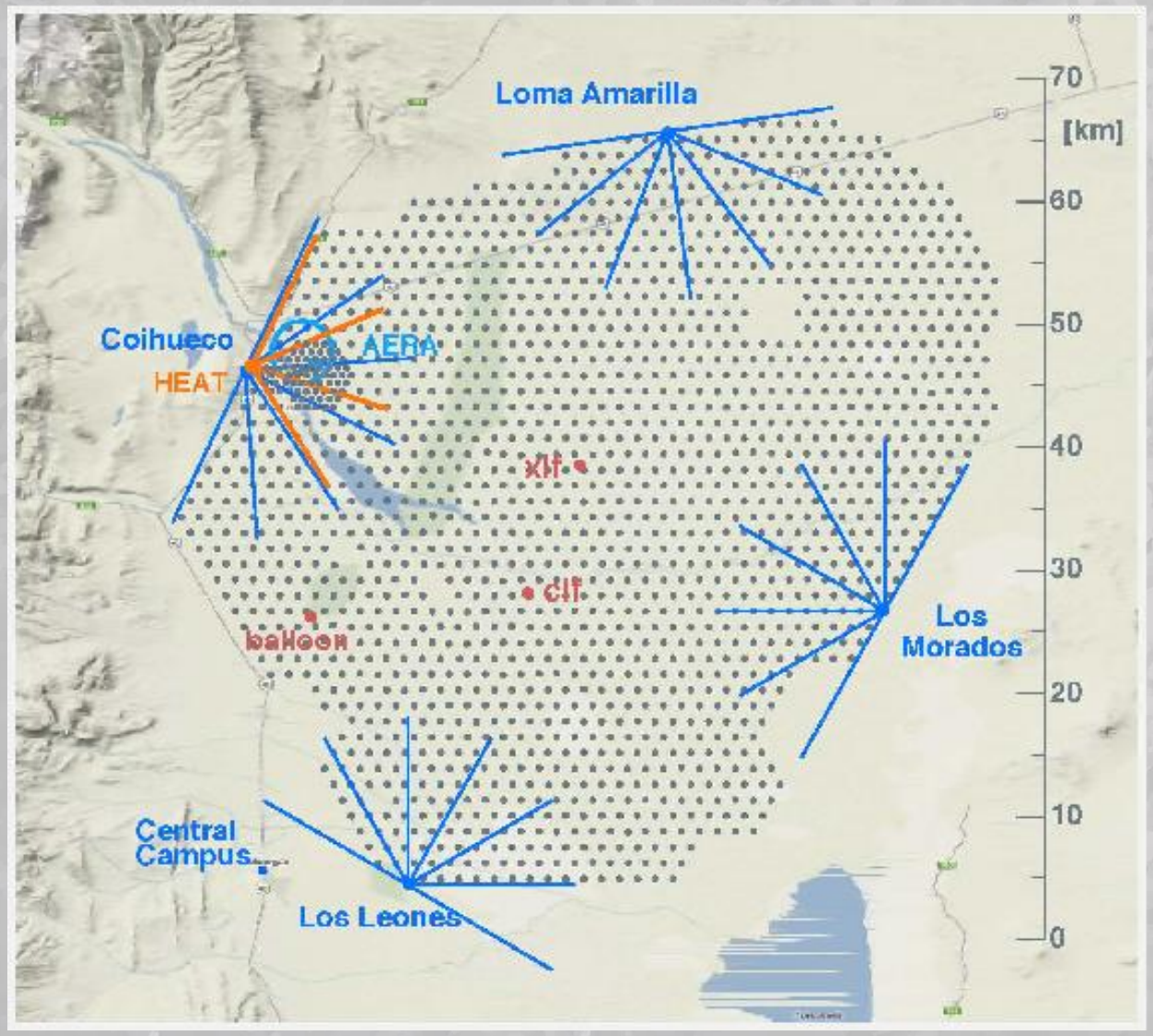


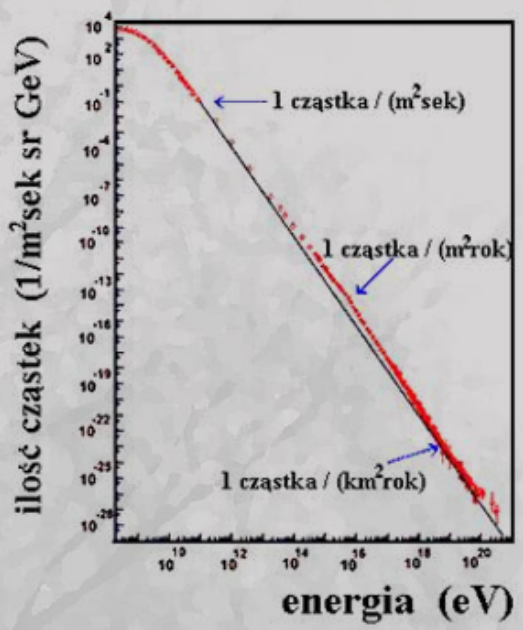
KASCADE Grande (~1960-2013)

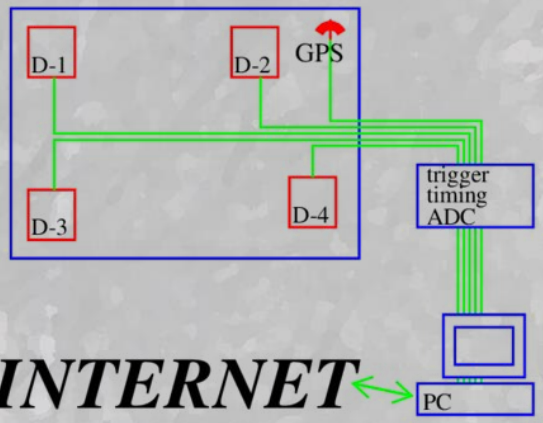


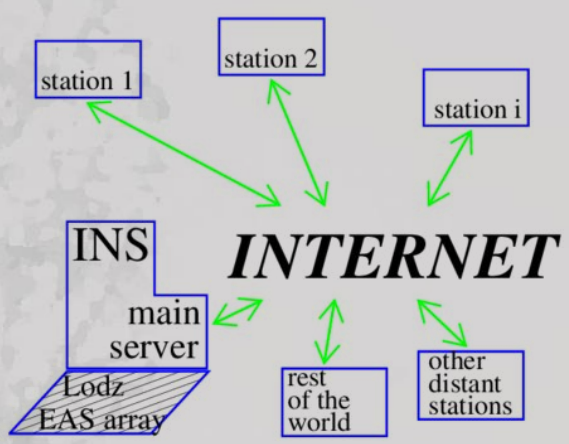


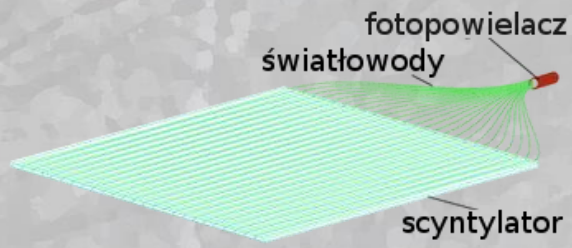

International Space Station (ISS)
JEM-EUSO
UV photon
Extensive Air Shower (EAS)

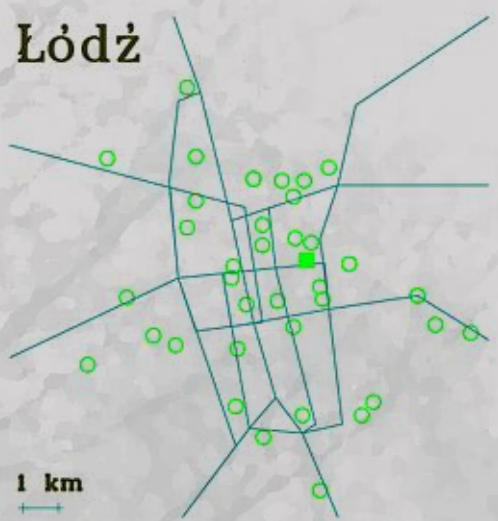

Loma Amarilla
Coihueco
HEAT
AERA
XLF
CLF
Balloon
Los Morados
Central Campus
Los Leones
70
[km]
60
50
40
30
20
10
0


1 cząstka / (m²sek)
1 cząstka / (m²rok)
1 cząstka / (km²rok)
ilość cząstek (1/m²sek sr GeV)
energia (eV)









5 sierpnia 2005, godzina 14.30