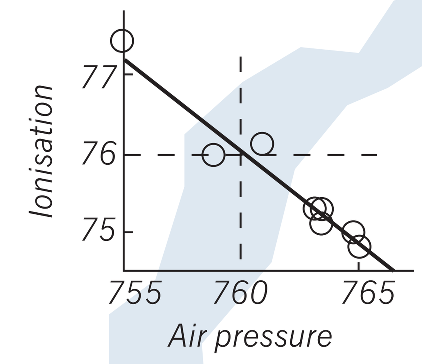
1926—1933 Investigation of Properties

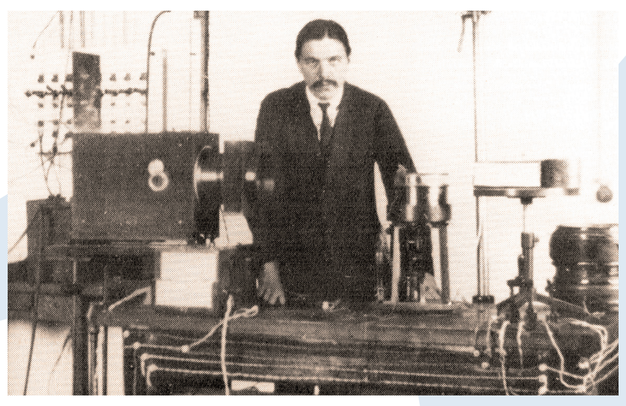
1926 — L Myssowski, L Tuwim: Barometric effect

The dependence of the ionisation rate on barometric air pressure was discovered in a three-week measurement. An electrometer was installed 1m below the surface of the Neva River in Leningrad (now St Petersburg). An explanation for the observed increase in the rate with decreasing air pressure was given many years later when muons and pions were discovered in cosmic particle interactions.



The dependence of ionisation on air pressure (from Myssowski, Tuwim, Physikalische Zeitschrift, 39, 146 1926)

1927—1929 — D Skobeltsyn: First cosmic ray tracks in the cloud chamber

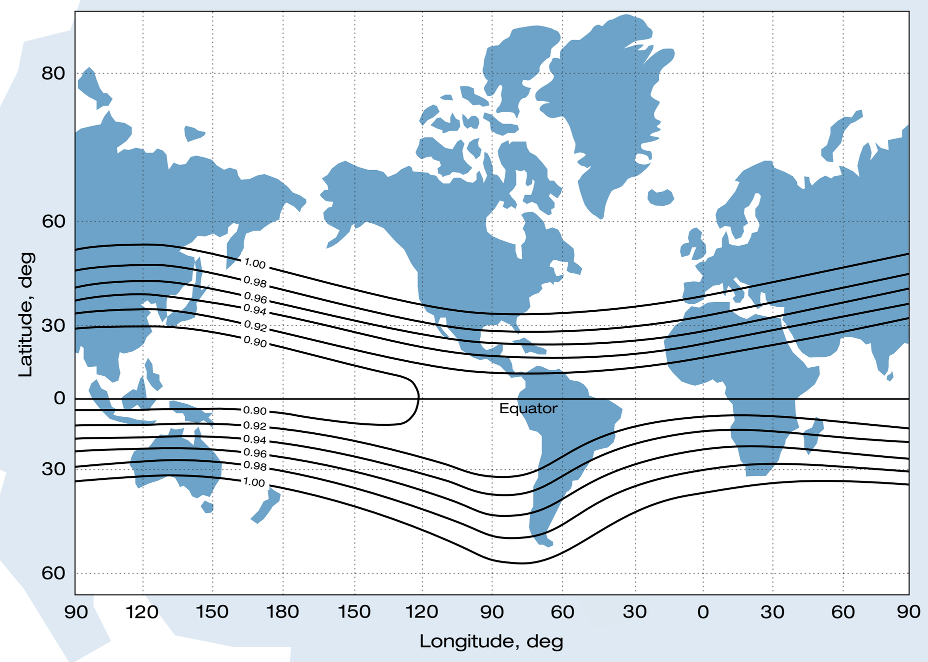


D Skobeltsyn in his laboratory in Leningrad

In 1927 Skobeltsyn investigated beta rays in a cloud chamber operating in a magnetic field. By chance, he observed in two pictures straight tracks which he interpreted as being due to high-energy cosmic rays. In a dedicated experiment, he found 36 tracks in 600 photographs. This was the first visual proof for the existence of charged secondaries produced by cosmic rays.

1927—1937 — J Clay, AH Compton et al: Latitude effect

A possible dependence of the cosmic ray rate on latitude was predicted by Kolhörster in 1919. Sailing in 1926 from Amsterdam to Indonesia, J Clay used an electrometer to measure the expected decrease of the ionisation near the equator.
Through a worldwide measurement campaign initiated by Compton in the 1930s, the effect was established. This was the definitive proof that a part of the primary radiation consists of charged particles.

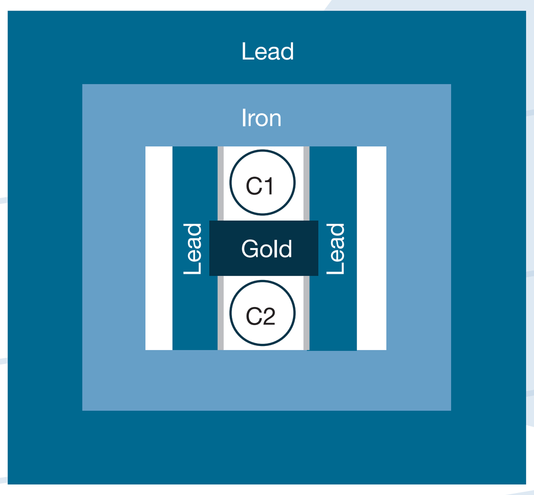


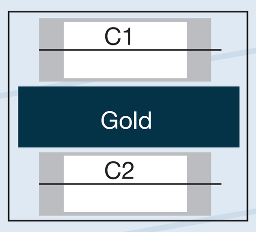
The relative cosmic particle intensity as a function of geomagnetic latitude

1928 — H Geiger, W Müller: New cosmic particle detector

In 1928 Geiger and Müller announced the development of a new detector. The counter consists of a metal tube filled with gas, and an isolated wire at a positive high voltage in the tube centre. If a particle crosses the tube, the gas becomes ionised and the electrons move to the wire, yielding a measurable signal.

1928 — W Bothe, W Kolhörster: Experiment with Geiger-Müller counters in coincidence





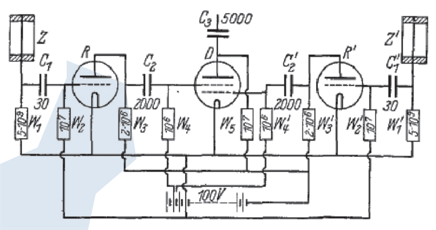
Absorber experiment with Geiger-Müller counters C1 and C2 in coincidence

Bothe and Kolhörster designed a trend-setting experiment to measure the absorption of cosmic rays with two Geiger-Müller counters in coincidence. The passage of a cosmic ray through both counters could be observed using electrometers.
The absorption measurements were taken with and without a gold block between the counters. Coincidences could only be caused by particles, not by gamma rays. This was additional proof that at least a part of the secondary cosmic radiation consists of corpuscular particles.

1928 — W Bothe: Invention of the coincidence circuit

Shortly after the absorption experiment, Bothe invented the electronic coincidence circuit. The concept was improved many times and is still an essential element in particle and astroparticle experiments.

Electronic coincidence circuit. There is a signal at C3 only if counters Z and Z' are crossed by the same particle.



1929 — W Pauli: Prediction of the neutrino

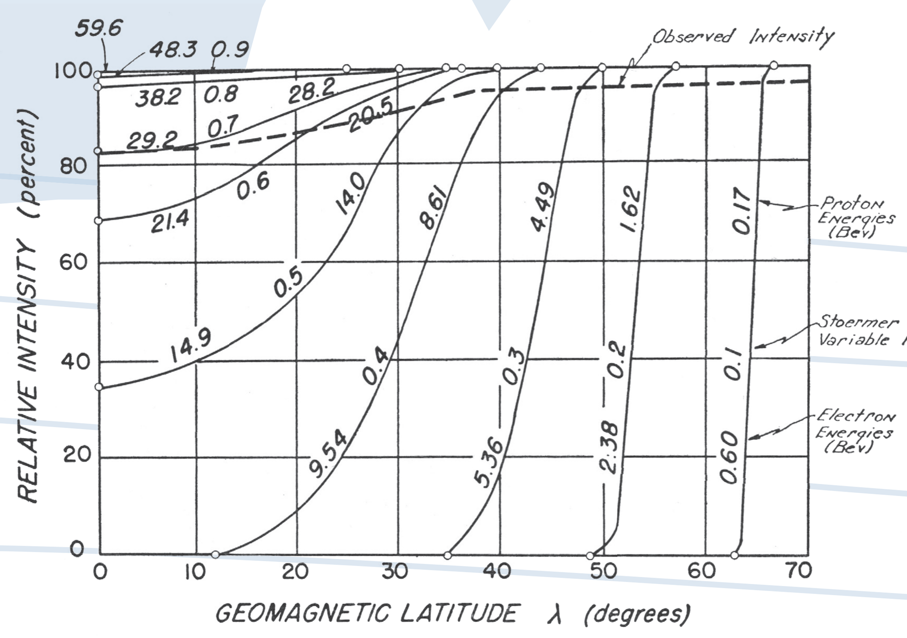
The neutrino was introduced by Pauli as a neutral particle to save the momentum conservation of the beta decay, which has to be a three-body decay. He assumed that it would never be detectable.

1929—1933 — J Joly: Biological impact

J Joly from the University of Dublin was probably the first to discuss possible biological impacts of cosmic radiation on the variation of species due to the interaction with chromosomes or on the incidence of cancer.

1930—1937 — C Störmer, G Lemaitre, MS Vallarta: Trajectories in the Earth's magnetic field

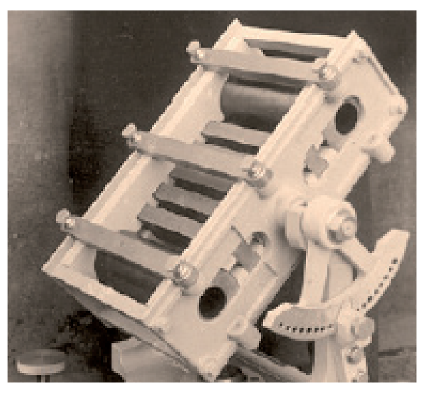
A visionary explanation for the appearance of the aurora borealis was given in 1898 by K Birkeland. Electrons emitted by solar flares are guided by the Earth's magnetic field to the polar areas and excite the molecules of the atmosphere.
Based on this theory, Störmer (1930) and Lemaitre and Vallarta (1934) calculated the trajectories of cosmic particles.



The relative cosmic particle intensity as a function of geomagnetic latitude for minimum energies of electrons and protons

1931—1934 — B Rossi, T Johnson, L Alvarez, AH Compton: East-west effect

B Rossi (middle) in Eritrea



Geiger-Müller counter telescope

B Rossi's prediction of an east-west effect based on Störmer's calculations of cosmic particle trajectories in the Earth's magnetic field. Particles with a positive charge should enter the atmosphere from the west, those with a negative charge from the east.
The effect was first demonstrated by Johnson and independently by Alvarez and Compton in 1932 at high altitude and low latitude in Mexico. Rossi confirmed the results in 1933 with his measurements in Eritrea.

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