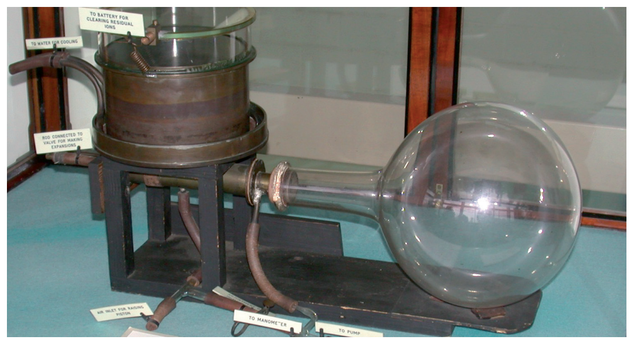
1912 Discovery by Victor Hess

1911

CTR Wilson: Development of the cloud chamber and publication of the first pictures

In 1895 CTR Wilson started investigating cloud formation in dust-free air. He discovered that condensed bubbles appear when air molecules are ionised by X-rays. In 1911 Wilson demonstrated with a cloud chamber that alpha and beta rays could be visualised. Two of the published pictures contained straight tracks which were probably the first photographs of cosmic particles. One year before their discovery, Wilson misinterpreted these tracks as beta rays.



Original Wilson cloud chamber (Cavendish Museum)

1911—1912

VF Hess: Calibration measurements with gamma rays

VF Hess in his lab in 1915

In 1910 Hess became an assistant at the just-founded Radium Institute of the Imperial Academy of Sciences in Vienna. He performed absorption measurements in air with the strongest gamma source available at the institute and experimentally confirmed the absorption coefficient predicted by Eve.
He improved the electrometer's construction and developed a calibration method for electrometers using gauge radium sources of different strengths. For calibrated detectors from the company Günther & Tegetmeyer (Braunschweig), the accuracy when measuring the strength of unknown sources was about 5 per mil; uncalibrated instruments achieved 3% accuracy.

1911

VF Hess: First three balloon flights

In August and October of 1911, Hess performed three balloon flights reaching altitudes of 200m to 1000m and confirmed the findings of Wulf, Bergwitz and Gockel. To prepare for a new series of flights, Hess designed and ordered improved instruments, two for gamma-ray detection and one with thin detector walls to measure beta rays.

Victor F Hess in the balloon's basket sometime between 1911 and 1912

1912

VF Hess: Six balloon flights from the Prater in Vienna at lower altitudes

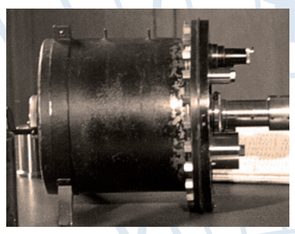
Six new flights were financed by the Imperial Academy of Sciences and supported with balloons from the Royal Imperial Austrian Aeronautical Club in Vienna. Hess measured the ionisation mainly with two or three electrometers:

1. 17 April, during an eclipse of the sun at 1900m—2750m of altitude
2. 26—27 April, at night for six hours at 300m—350m of altitude
3. 20—21 May, at night at 150m—340m of altitude
4. 3—4 June, at night at 800m—1100m of altitude
5. 19 June, in the afternoon at 850m—950m of altitude
6. 28 June, at night at 280m—360m of altitude

7 Aug 1912

VF Hess: Seventh balloon flight, reaching an altitude of 5350m Discovery of cosmic rays

With the hydrogen-filled balloon Bohemia, provided by the German Aero Club in Bohemia, Hess, together with W Hoffory and E Wolf, reached an altitude of 5350m and landed at noon in Bad Saarow/Pieskow in Brandenburg. All three detectors measured a strong increase in ionisation.



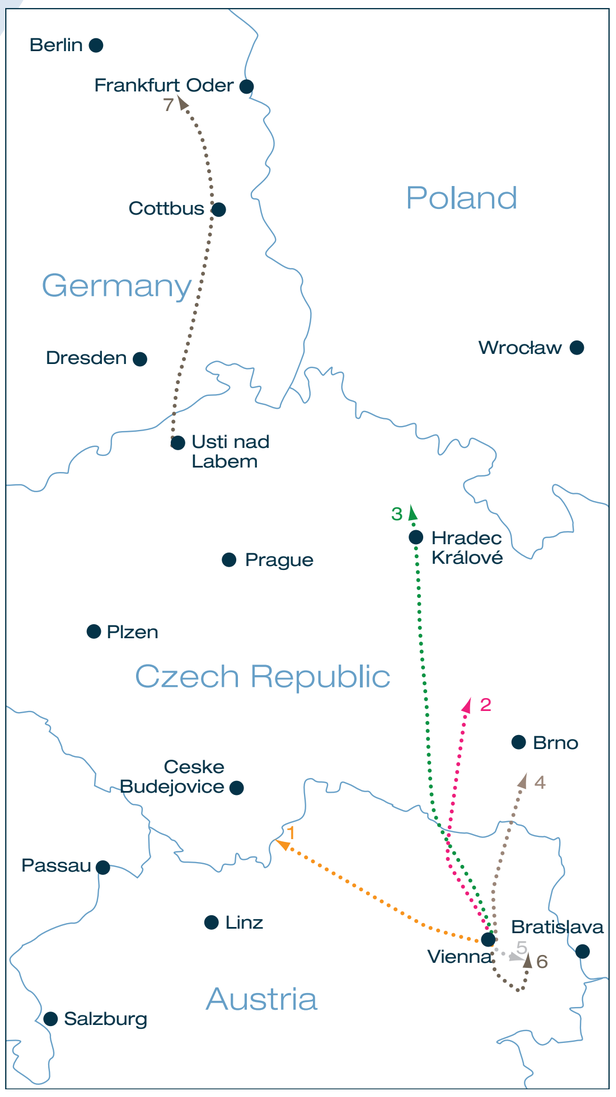
Electrometer used by VF Hess in 1912

Physik. Zeitschr. XIII, 1912. Hess, Durchdringende Strahlung bei sieben Freiballonfahrten. 1089

Tabelle der Mittelwerte.

Mittlere Höhe über dem Erdboden m	Beobachtete Strahlung in Ionen pro ccm und sec.			
	Apparat 1	Apparat 2	Apparat 3	
	Q_1	Q_2	Q_3 (reduziert)	Q_3 (nicht reduziert)
0	16,5 (18)	11,8 (20)	19,6 (9)	19,7 (9)
bis 200	15,4 (13)	11,1 (12)	19,1 (8)	18,5 (8)
200—500	15,5 (6)	10,4 (6)	18,8 (5)	17,7 (5)
500—1000	15,6 (3)	10,3 (4)	20,8 (3)	18,5 (2)
1000—2000	15,9 (7)	12,1 (8)	22,2 (4)	18,7 (4)
2000—3000	17,3 (1)	15,3 (1)	31,2 (1)	22,5 (1)
3000—4000	19,8 (1)	16,5 (1)	35,2 (1)	21,8 (1)
4000—5200	34,4 (2)	27,2 (2)	—	—

Mean values of all measurements during the seven flights at different altitudes (the number of ionisation values in brackets)



Seven flight routes of VF Hess in 1912

VF Hess summarised the results of these seven flights as follows:

- At altitudes of less than 1000m, the results are in general agreement with previous measurements.
- A radiation of high penetration power hits the atmosphere from above, which cannot be caused by radioactive emanations.
- This radiation contributes to the total amount of observed ionisation at lower altitudes as well.
- Assuming gamma radiation, the sun is not the source of the extraterrestrial radiation.
- There is no difference between ionisation measured during the day and at night.

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