the end of the range, as is the case for α -particles, but has a maximum at the beginning of its path and then decreases slowly, until at the end of its range it approaches that of an α -particle (see accompanying diagram). This effect is presumably due to capture of extra nuclear electrons.

We do not think it very likely that this track represents the mere recoil from the original cosmic ray particle. The recoil tracks in even very energetic disintegrations are very short, and besides, there is no reason why the recoil nucleus should have such a high effective charge. In all probability we are dealing here with a heavy, highly charged splinter, released by a highly excited heavy nucleus, a process which bears some similarity to the fission of the uranium nucleus.

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¹ Blau and Wambacher, *Sitz. Akad. Wien*, **146**, 623 (1937).

² Schopper and Schopper, *Phys. Z.*, **40**, 22 (1939).

³ Schopper, *Naturwiss.*, **25**, 557 (1937).

Temperature of the Stratosphere in High Latitudes

We recently directed attention¹ on the variation of the 'mean temperature' of atmospheric ozone, which appeared from the observations made by Barbier,

altitudes not accessible to sounding balloons; and next, that the stratosphere has been investigated chiefly in low and middle latitudes.

Rolf², however, at Abisko between 1921 and 1929, carried out a long series of measurements showing that above the tropopause the temperature decreases slightly in January, while in June it increases in a regular manner, as may be seen in the accompanying graph.

For the sake of comparison, there are represented on the same graph similar curves deduced from radio soundings made at Saint-Cyr (lat. 48° 47' N.).³ Recently published observations, made by Carmichael and Dymond⁴, suggest that this increase of temperature in summer is yet more marked (25° C.) in higher latitudes (about lat. 79° N.).

Thus, direct measurements point to an annual change in the temperature of the stratosphere, and the higher the altitude, the greater the difference between the summer and winter temperatures. In arctic countries, this change is much greater than in lower latitudes. This was also noticed by Penndorf⁵.

The measurements of the mean temperature of atmospheric ozone, as they reach much higher regions in the stratosphere, are an extrapolation of the balloon measurements, and strengthen the opinion that this annual variation increases with altitude. Thus the earth's atmosphere offers two arctic zones, by turns very cold in winter and very warm in summer.

Solar radiation would be responsible for these variations. For it is easy to estimate, for a given day, the time when the higher layers of the atmosphere are illuminated; taking also into account the obliquity of the sun's rays, a strong correlation is found between the illumination and the mean temperature of ozone.

In addition, Gowan's calculations⁶, though they deal with lower latitudes (50° N.), show a large difference in the higher layers of the stratosphere between the actual temperature and the temperature when the atmosphere is plunged in darkness during a sufficient time for equilibrium to be attained, which is nearly the case in polar night.

One of the consequences of the related phenomenon is a possible explanation, owing to the dependence of the velocity constant of thermal decomposition on temperature, of the decreasing ozone thicknesses at Abisko which are shown by Dobson's curve⁷.

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Chalange and E. Vassy at Abisko (Swedish Lapland, lat. 68° 20' N.) between December 27, 1934 and March 6, 1935. From the end of December until the beginning of March, the temperature gradually increased by about 70° C. This great variation may seem surprising, as the stratosphere is known to have a rather constant temperature; but it should first be noticed that the mean temperature of atmospheric ozone involves

¹ Vassy, A. and E., *C.R.*, **208**, 1518 (1939).

² Rolf, B., *Med.-Statist. Met.-Hyd. Anst.*, **5** (1932).

³ Unpublished material published by courtesy of the Office National Météorologique.

⁴ Carmichael, H., and Dymond, E. G., *Proc. Roy. Soc., A*, **171**, 345 (1939).

⁵ Penndorf, R., *Veröff. Geoph. Inst., Leipzig*, **8**, 181 (1936).

⁶ Gowan, *Quart. J. Roy. Meteor. Soc.*, **62**, Supp., 36 (1936).

⁷ Dobson, G. M. B., *Proc. Roy. Soc., A*, **129**, 411 (1930).