(cm.$^{-3}$ sec.$^{-1}$) in excess of those generated in the same box on the ground :—

| Height km. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| $q$ | 0 | −1·5 | 1·2 | 4·3 | 9·3 | 17·2 | 28·7 | 44·2 | 61·3 | 80·4 |

The decrease in the first kilometre is due to the cutting off of the penetrating radiation from the radio-active contents of the ground by the lower layers of the atmosphere. The great increase in the ionisation from 2 km. to 9 km. is clearly shown.

The war has naturally put an end to further observations in balloons, but not to the search for the origin of this amazing radiation.

In a paper published in the Elster and Geitel *Festschrift*, E. v. Schweidler discusses several possible sources of the radiation, only to reject them all. He first calculates the absorption coefficient of the new radiation, assuming that it is penetrating vertically downwards through the atmosphere, and finds $\mu = 7{\cdot}46 \times 10^{-6}$ cm.$^{-1}$ and $\mu/D = 5{\cdot}77 \times 10^{-3}$ cm.$^2$/gram (the corresponding values for $\gamma$ radiation from radium being given by Rutherford as $6{\cdot}0 \times 10^{-5}$ cm.$^{-1}$ and $4{\cdot}6 \times 10^{-2}$ cm.$^2$/gram respectively). Applying these values to the observations, he finds that on the confines of the atmosphere 535 ions (cm.$^{-3}$ sec.$^{-1}$) would be generated in air at standard density. Assuming, then, that the radiation is similar to that sent out by radio-active substances, he calculates that if all the new radiation came from the sun the latter would have to possess a specific activity 170 times as great as that of pure uranium. This he considers to be a quite impossible value.

Schweidler then considers the possibility of the radiation being due to a radio-active gas in the atmosphere, and shows that if the gas obeys Dalton's law, the rate of increase of $q$ with height would be entirely out of agreement with the observed values.

The only hypothesis considered by Schweidler which is not entirely out of agreement with the observations is that cosmical space is filled with a radio-active gas. The calculation shows that, strange as it may seem, the radiation would be independent of the density of the gas, which would only need to have a specific activity 1/1200 of that of uranium to provide the observed ionisation. Needless to state, Schweidler does not favour this latter explanation.

In the *Meteorologische Zeitschrift* for April, 1916, Linke attempts to solve the same problem. He shows that the observations fit in very well with the ionisation which would be produced by a layer of radio-active substance spread uniformly throughout the atmosphere at a height of 20 km. In this case the rays would not penetrate only vertically downwards, but in all directions. This alters the coefficient of absorption from $\mu = 7{\cdot}46 \times 10^{-6}$ cm.$^{-1}$, as calculated by Kolhörster, to $4{\cdot}6 \times 10^{-6}$, as calculated by Linke.

Linke concludes that there is a layer of cosmical dust in the stratosphere, which is strongly radio-active, and supports it by the following considerations :—

(*a*) The presence of dust in the stratosphere is clearly shown by several optical effects—for example, twilight phenomena and Bishop's rings.

(*b*) Dust which is present in the stratosphere cannot fall into the troposphere except with great difficulty, owing to the temperature inversion, which is a well-known trap for dust.

(*c*) There was a considerable increase of this dust after the earth had passed through the comet's tail in May, 1910.

(*d*) On this occasion Thomson, in America, observed a sudden increase in the penetrating radiation measured near the ground.

Many more observations are necessary before Linke's hypothesis can be accepted, so it is no use considering it in further detail. For physicists, however, the most interesting fact is that these observations leave little doubt of the existence of a new extremely penetrating radiation, which increases as one ascends in the atmosphere.

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### Airplanes and Atmospheric Gustiness.

IN a recent discussion of the action of an airplane encountering gusts, it is stated that a velocity of about six metres per second may be regarded as a mild gust. Making use of an exponential equation and starting from a condition of still air, increasing to a certain intensity, the value of the exponent is taken as determining the sharpness of the gust. With a value of 1, the gust reaches nearly its maximum value in one second, which would be a decidedly sharp gust.

It is evident from the discussion that data for the natural conditions are meagre; in fact, it seems plain that the engineers have entirely underestimated the velocities likely to be met with in the free air at low altitudes. And gusts do not as a rule begin from a still condition. Moreover, since the flow of the air may be upward, downward, inclined, or on the level, straight or rotary and superimposed on steady or intermittent general motion, it will be difficult to express in a general formula the condition of flow in a gust; and possibly no two gusts will be alike.

The problem of the stability of an airplane in a gusty atmosphere belongs without doubt to the aeronautical engineer; but there is another problem, that of systematically recording the general character of the air flow with regard to gustiness, which belongs to the aerographer; and it will be readily conceded that this latter problem is now one of some moment. The question is then, How shall gustiness be recorded in the various observatories of the world?

We are attempting at Blue Hill to record each day the number of hours during which aviation is considered safe and unsafe. Our method is doubtless crude, for we use the wind velocities indicated on an anemo-kinemograph, counting as safe those hours during which the average velocity does not exceed 10 m./s., and there is no variation greater than 50 per cent. in five minutes. For example, the records of March 2 and 5 (not reproduced here) illustrate days on which respectively there were 24 and 0 hours suitable for aviation. Incidentally we have been able with another instrument to obtain records showing a variability of 50 per cent. in three seconds; also velocities as high as 60 metres per second; and one true gust in which the total air flow was 370 metres in ten seconds, of which 300 metres occurred in five seconds.

Since we have no International Committee—and let it be said, not in bitterness, but sadness, that it is quite unlikely that representatives of certain nations will be welcomed at any international conference for years to come—there is no way now open to reach an agreement unless the British Meteorological Office will be willing to formulate a definition. Under its progressive director it has become the leading and representative Service, and one the methods of which will be generally accepted.

This particular feature of the weather has not heretofore received much notice, other than the recording of days on which gales occurred; but it is evident now that a more detailed record of the condition known as gustiness must be kept.

Perhaps some of the readers of NATURE can offer suggestions?

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