10 per cent. of the whole, and it is not necessary to discuss them here in detail. They consist of—(1), 3 days when energy was available below the 700 mb. level, though thunder was not reported, and (2), 4 days with thunder, though little or no energy was shown. As regards (1) it must be remembered that thunder may occur but escape the network of Daily Weather Report stations; and as regards (2), Duxford will not always be typical of the air over the south-east of England for the remainder of the day.

As regards Class B, it is scarcely surprising to find that energy developed above the 700 mb. level is ineffective in producing thunderstorms, when it is remembered that the moisture content of saturated air above this level is comparatively small.

The close association between energy and thunderstorms shown by these ascents is most encouraging for the forecasting of thunderstorms and gives further proof, if such were needed, of the importance of regular aeroplane ascents to a modern forecast service.

J. S. DINES.

Meteorological Office,
Air Ministry, May 13.

### New Experimental Results concerning the Doublet $K\beta_1$.

IN a communication under this title in NATURE of April 17, p. 554, N. Seljakow and A. Krasnikow have inferred from measurements on the lines $K\beta_1$ and $K\beta'$ in the Röntgen spectrum of manganese, that they form a relativity doublet characterised by the energy difference $M_{II} - M_{III}$. Now with molybdenum the corresponding difference is about 0·8 $\frac{\nu}{R}$ units, whereas with elements of lower atomic number similar measurements have so far not been published. The very small value found for molybdenum makes it reasonable to suppose that, for the elements between calcium and zinc in the periodic system, the corresponding energy difference would not give rise to any separable lines. For even if we assume the appearance of $3_3$-orbits, which begin with scandium, to cause a disturbance in the $M$-level, so that the $3_2$-orbits are unequally screened for this and the next element, it still follows from an approximate calculation that this effect cannot possibly give rise to a larger difference than about one-third of that actually measured. On the other hand, the broadening of the $K\alpha$-doublet of iron found by Siegbahn and Ray (*Ark. Mat., Astr. Fysik*, vol. 18, No. 19) and recently studied by Thoraeus (*Phil. Mag.* (7), vol. i. p. 312, 1926), which represents a much smaller value of the energy difference, may well be attributed to such a screening effect of the $3_3$-orbits, as this would, of course, be equivalent to a slight increase of the nuclear charge.

With the $K\beta$-lines, the interpretation of the doublet as due to a relativity effect would doubtless require a more detailed explanation. The intensity ratio $\beta_1 : \beta' = 2 : 1$, which supports this interpretation, appears so far to have been definitely established only with manganese (N. Seljakow and A. Krasnikow, *Zs. f. Physik*, 33, 601, 1925). Investigations by the writer carried out in this Institute seem to prove that with iron in compounds the intensity ratio (estimated) has also approximately the same value, *i.e.* 2 : 1. With titanium and vanadium, however, a value considerably larger than 2 : 1 was found.

Seljakow and Krasnikow also state that the intensity ratio $\beta_1 : \beta'$ is not sensibly affected by passing the rays through foils of the same element. A similar observation on the satellite lines in the $L$-series of the rare earths has been described by D. Coster (*Zs. f. Physik*, **25**, p. 98, 1924). This fact supports the view that the $K$- or $L$-electron is completely removed from the atom in the absorption process. Moreover, the explanation suggested by G. Wentzel (*Ann. der Physik*, **66**, p. 458, 1921), who attributes the satellites to supernumerary excess electrons in the $M$-level, does not appear to be refutable on this basis.

Another point should be noticed in this connexion. The elements of the rare earths offer many analogies to those between calcium and zinc. A $4_4$-orbit occurs for the first time with cerium, where also the $\beta_{14}$ and $\gamma_9$ lines have been found by D. Coster to accompany the $\beta_2$ and $\gamma_1$ lines, as satellites of lower frequency. The increase in intensity of these satellites with increasing atomic number appears to be closely analogous to that of the $\beta'$-satellite for the elements next to iron. On the other hand, a cursory examination of the energy levels of the rare earths seems to exclude a relativity explanation of the satellites in the case of cerium and the following elements.

The interpretation of the $K\beta_1\beta'$ lines as a relativity doublet, offered by the Leningrad physicists, appears therefore scarcely admissible, whereas the hypothesis of Wentzel seems to be in better agreement with the experimental facts. If we try to estimate the effect of the supernumerary electrons involved by this hypothesis, we are led to the conclusion that such electrons cannot be limited in number to only one, otherwise we must assume rearrangements of the electron groups to occur. Especially the fact that the $\beta'$-line appears sensibly broadened seems to exclude a normal energy level as the origin of this line, and to support the view that several kinds of radiating atoms may co-exist, these differing from each other in the number or arrangement of their electrons within the $M$-level

G. ORTNER.

Institut für Radiumforschung,
Wien, May 10.

### Wasteful Research ?

THE issue of NATURE of May 1 contains a letter by Messrs. Morgan and Holmes from the new government "Chemical Research Laboratory, Teddington," describing results of their study of certain fatty materials. I venture to ask directly and plainly: Why is such work being done in a State laboratory? Years ago there was much heartburning among consulting chemists because the National Physical Laboratory was taking the bread out of their mouths. Is it now to be the turn of the universities and technical schools to suffer from the State poacher? The work described is purely academic, such that any intelligent fourth-year student could do.

To-day the chemical schools are in large part engaged in so-called research which is of no consequence and often detrimental as training—clearly because they are led by men without practical outlook. These need even to have practical subjects of study forced upon them, which will afford their students training in laboratory methods. With scarcely an exception, the real work that is being done in chemistry is with materials of natural origin. Fats are among them. A special technical professorship to deal with these has only recently been established in Liverpool, and is in specially able, experienced hands. Another of the professors in that University, only a month or two ago, made known the results of several years' close study of perhaps the most remarkable fat yet examined—that from shark's liver. The inquiry is probably the most finished and meritorious piece of work of the day. Sir William Bragg's school