The methods of investigating mediums must naturally be adapted to circumstances, since, as in experimental psychology, the human factor is concerned. But at present the investigations, if they can be called such, are carried out under the necessity of obeying sets of purely arbitrary and unproven 'laws,' invented by spiritualists and others, of which the chief result seems to be to prevent exact knowledge being acquired.

Doubtless it is possible, although in our opinion improbable, that psychic phenomena can only occur under conditions which render it impossible to ascertain their real nature. It may be that, in the case of experimental telepathy, for example, if we exclude normal processes such as codes, etc., the supernormal element cannot come into operation. If this be so, it is clear that science must prefer the theory that normal *causes* are sufficient, even though it may be difficult to determine precisely at each point what kind of normal factor is active.

Until we know more of the unknown elements said to be present in psychic phenomena, it is premature to discuss theoretical considerations. Knowledge can only be obtained by careful systematic investigation, by free, unhindered inquiry, and by exact and varied experiment. When results are obtained under these conditions which can be compared and verified in a number of cases, it will be time to determine whether the extension in our knowledge demands an appeal to extra-mundane influences.—THE EDITOR.]

Active Nitrogen.

IN a brief discussion of active nitrogen in NATURE of Sept. 15, by Mr. C. N. Hinshelwood, there are several statements which should be modified in view of some recent work done by several investigators.

The statement is made in the article: "In the presence of more than about 2 per cent oxygen, the nitrogen does not glow at all." This has been shown to be wrong. I have shown that active nitrogen is produced when a condensed discharge is passed through air at 0·5 mm. pressure (*Proc. Nat. Acad. Sci.*, **14,** 258; 1928). Herzberg (*Zeit. f. Physik*, **46,** 878; 1928) showed that it was possible to produce glowing active nitrogen in mixtures of nitrogen and oxygen in which the percentage of nitrogen varied from 100 per cent to 40 per cent. Earlier than either of the above experimenters, Hagenbach and Frey (*Phys. Zeits.*, **18,** 144; 1917) showed that glowing active nitrogen could be produced from air. The spectra observed by all these authors was the same as that obtained from active nitrogen that has been produced from almost pure nitrogen.

Elsewhere in Mr. Hinshelwood's article the statement is made that a few of the first positive bands of nitrogen are prominent in the afterglow and "the rest entirely absent." Rayleigh observed in one of his earlier spectroscopic investigations of active nitrogen (*Proc. Royal Soc.*, **85,** 377; 1911) that in addition to the very prominent bands in the afterglow, other bands of the α group appeared. At the time that these bands were observed, Rayleigh ascribed them to stray light from the discharge tube or to stray discharges. In a later paper (*Proc. Royal Soc.*, **102,** 453; 1922) Rayleigh photographed these bands again, and definitely assigned them to the afterglow. During the past year Dr. G. Cario and I have photographed the afterglow in the visible and in the near infra-red, and it has been found that practically the entire first positive group of nitrogen is present in the afterglow. The idea, therefore, that the afterglow spectrum consists of only a few selected bands of the first positive group is wrong. A full account of this work is to appear soon.

We wish further to discuss the statement that the assumption of metastable nitrogen molecules in the afterglow must be made "directly for the purpose of explaining the facts, and without independent evidence." The first electronic level of the nitrogen molecule is known as the A level and possesses about 8 volts energy. This level has long been suspected of metastability because of the absence of transitions between it and the normal level in either emission or absorption. The absence of these transitions is in agreement with the assignment of the A level to the triplet system and the normal level to the singlet system, since intercombinations are highly improbable. Other experimental evidence as to the existence of metastable molecules in active nitrogen has been given by me (*Phys. Rev.*, **31,** 1126; 1928). Both of these pieces of evidence are independent of any theory as to the nature of active nitrogen and should therefore be considered in proposing any explanation of active nitrogen.

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IT is interesting to know that under certain conditions the glow can be produced in presence of air: the fact, however, remains that under those used by Lord Rayleigh oxygen destroyed it.

I take it Dr. Kaplan does not suggest that the *prominent* bands are other than those described by Rayleigh, or that the intensity relationships are not much displaced. This still seems the most important fact, though it is also interesting that the other bands can be found. Dr. Kaplan does not mention the intensities of the bands he and Dr. Cario find. Presumably they are very faint.

I have not yet read Dr. Kaplan's paper in the *Physical Review* of 1928: but the first piece of evidence mentioned does not seem to me to be more than a suggestive analogy. I agree at least that it is that.

C. N. HINSHELWOOD.

Secondary Absorption Edges in X-rays.

RECENTLY Nuttall (*Phys. Rev.*, **31**; 1928) has examined the X-ray absorption spectra of simple compounds like potassium chloride and found six absorption edges (designated as A, B, C, D, E, and F) both for potassium and chlorine atoms, all of which lie on the short wave-length side of the primary K-limit. The wave-lengths of the first four of these agree well with those found by Lindh in chlorine compounds of different valencies.

Following the well-known theory of Kossel that the fine structure limit should in no case exceed the ionisation potential of the atom, Coster, Robinson, Stoner, Lindsay, and others have tried to explain the secondary edges which lie outside the fine structure limit as due to the multiple ionisation of the atom. On this view, then, the frequency of the characteristic emission lines of these ionised atoms will be changed so much as to be clearly resolved by the spectrograph (Ray, *Phil. Mag.*, vol. 1; 1925), but no such large shift in emission has yet been observed. Thus neither the valency nor the ionisation theory explains satisfactorily the presence of these absorption edges. I believe that a simple explanation of these observed phenomena can be given on the following lines:

In the ordinary absorption phenomena the energy in the incident radiation is utilised in removing an electron from one of the energy levels (say K level) to levels which lie beyond the periphery of the atom. Radiation of higher frequencies is also absorbed and