would have a principal line, $\lambda = 694 \cdot 5 \cdot 10^{-8}$, between the ultra-violet and the X-ray regions.

But there is a serious difficulty. If $N = 20$, $n = 4$, where are the other 16 electrons required to make the atom neutral? Perhaps it is more reasonable to suppose that N for calcium is higher, and given by $N - S_N = 19$. In this case, N would not denote the place of the element in the periodic table, but would allow for intermediate and unstable forms of matter—an allowance which may well be necessary. The only alternative is to explain X-rays by the structure of the nucleus. Any internal ring must be one of doublets, such as neutral α particles.

There is one other point to which I must refer. Mr. Moseley states that he has not found a correspondence between the X-ray spectra and the vibrations of the element nebulium treated in one of my papers. This correspondence is not to be expected, for the two investigations are unrelated. The simple-ring atoms which I have used to interpret astrophysical spectra are supposed to have a *simple* nucleus, or to contain no α particles, and to be incapable of giving series spectra. They are not identical with ordinary atoms, into which, however, they appear to change in the stars which follow nebulæ in order of evolution, and, as is shown in a paper in the *Monthly Notices of the R.A.S.* for December last, almost certainly by a modification of their nuclei. When this change occurs, they show series spectra, which must depend on the nucleus, and perhaps on tubes of force, in a way which a mechanistic interpretation of Bohr's theory may perhaps explain. In a paper read at the January meeting of the Royal Astronomical Society, these series were shown to lead to the same conclusion as Bohr's with regard to the nature of a hydrogen atom.

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Prof. Turner and Aristotle.

IN *The Times* report of December 29, 1913, of Prof. Turner's lecture at the Royal Institution, his remarks on Aristotle are summarised in a way which will surely appeal to his sense of humour after his astonishment at my letter has abated.

"Aristotle said that a weight of 10 lb., for example, fell ten times as fast as a weight of 1 lb., and the world went on believing it for 2000 years. This raised the question whether it was better to believe things just because people told one, or to try to find out for oneself."

Aristotle never said this at all. Who first fathered it on to him will perhaps never be known now, but since Galileo made the statement notorious 323 years ago, the world has gone on believing it. If anyone wishes to find out for himself, let him consult the Teubner stereotyped Greek edition of Aristotle's "Physics," Book IV., cap. viii., sect. 8–11, or the Leonine edition of St. Thomas Aquinas's "Opera Omnia," tome ii., commentary on Aristotle's physics, texts 71 and 74, pp. 183–7. It is in the British Museum.

Aristotle is discussing the notion of a vacuum, and using the argument from motion. Lection xi. in "Opera Omnia," containing the argument, begins on p. 180, and is headed, "Ex parte motus ostenditur non esse vacuum separatum." An intelligible paraphrase of the important parts of texts 71 and 74, or sect. 8 and 11, is as follows:—"§ 8: We see that a heavy body is borne (or translated) faster for two reasons, either because of differences in the medium through which it passes, as earth or air or water, or other things being equal, because the body itself differs by reason of its superior gravity or buoyancy. As regards the medium, the reason is that it resists. . . . If air is twice as subtile as water, then for an equal distance the time of translation in water will be twice that in air. . . . § 11: As regards differences in the body itself. We see that those bodies which have greater potentialities of movement (*ῥοπὴν*, inclinationem), whether downwards by reason of their weight, or upwards by their buoyancy, other things being equal as regards their shape (*σχήμασι*, figuris) are translated quicker over equal spaces, and this according to their proportionate magnitudes. But why should this be so in a vacuum? Therefore a vacuum is impossible. But why is it that they have different rates of translation? In a plenum it is indeed of necessity, for that body which is the faster, is so by reason of its power or of its shape or of its potentiality of motion whether of translation or projection, whereby it divides the medium more effectively. But in a vacuum all are equally effective, so that all are faster than one another. Which is impossible." § 11 is usually relied upon to convict Aristotle of error, but it is evident that motion through a resisting medium is premised.

The commentary of the Angelic Doctor makes this quite clear. The reader will find, probably to his amazement, that the new and modern notions of velocity were explicitly present to his intellect when he wrote. Special attention may be directed to § 13 of the commentary on p. 187, beginning "Deinde eum dixit, Secundum autem eorum." He actually used the words, "vel propter aptitudinem figurae quia acutum est penetrabilius," just as though he was describing the peculiar property of a modern pointed bullet. In the new and technical language of gunnery "motus" or "motus naturalis" is rendered precisely by the expression, "terminal velocity," the velocity at which the retardation of the medium, air, is exactly equal to the acceleration of gravity, resulting in a constant speed of fall. That Aristotle ever supposed for an instant that a 2-lb. weight fell, in the ordinary sense of words, twice as fast as a 1-lb. weight is an absurdity. What he taught was that the terminal velocity of a heavy body, such as Prof. Turner's sovereign, was greater than the terminal velocity of a light body, such as a feather, in a medium such as air or water. A penny can never fall faster than about 30 ft. a second through air. I performed the experiment last week, dropping pennies from Clifton Bridge, 250 ft., into the Avon. They take eight or nine seconds to reach the water. Sir George Greenhill has often expressed doubts to me as to the correctness of the accusation against Aristotle's common sense, but could never persuade a scholar to find the passage. A year and a half ago he showed me the above reference in the introduction of Mr. Lones's new book on Aristotle's "Natural History," and asked me to look it up. I consulted St. Thomas's Commentary in the British Museum, with the startling result I have mentioned, and fetched my former professor over to the reading-room to verify my discovery. That he did verify it must be my apology as a soldier for intruding into the domains usually preserved for scholars and philosophers of the highest order.

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27 Cranbrook Road, Bristol, January 9.

TEUBNER's edition of Aristotle's "Physica" is out of print, but the equivalent passage is found in his Aristotle's "De Coelo" (C. Prantl), p. 73, where the law is enunciated that the terminal velocity of a body in a medium is proportional to the weight.

Aristotle's law was justified by Newton in his ex-