to suitable axes) is everywhere zero—at least so far as electromagnetic phenomena are concerned.

Though I find myself in agreement with Prof. Richardson's conclusion that magnetic intensity is not to be identified with speed of æthereal flow, as explained in his letter to NATURE of May 23, I venture to dissent from his arguments. These proceed from the contention that, on the contested assumption, certain integrals would become infinite. Now, in the first place, it appears to me from mere inspection that both these integrals (which I have not actually evaluated) are in reality finite; in the second place, neither integral expresses a magnitude which bears directly on the point at issue, one of them being justly criticised by Sir Oliver Lodge in NATURE of June 6 as apparently devoid of mathematical meaning. The question proposed is as to the momentum due to an electric charge upon a moving sphere, and in this connection the really significant magnitude is the kinetic energy, expressed in terms of the translational velocity. Differentiating this expression with respect to the velocity, we have at once the momentum, the result obtained being independent of any physical theory as to the ultimate nature of the energy in a magnetic field.

C. V. BURTON.

Cambridge, June 8.

Decomposition of Radium Bromide.

YESTERDAY, on opening a glass tube containing 1 milligram of radium bromide which had been hermetically sealed for almost exactly twelve months, there was a very strong odour of bromine which hung about the tube for about ten minutes. The amount of the bromide decomposed in this period would be about $5{\cdot}4\times10^{-7}$ grams according to Rutherford; the amount of bromine corresponding to this would be about 2×10^{-7} grams. Perhaps some chemist could say definitely whether this amount of bromine would be detectable by its odour. The volume of the tube was about 4 cubic centimetres.

ALFRED W. PORTER.

University College, London, June 8.

The Mass of the α Particle.

APPARENTLY the following simple and obvious method of calculating the mass of the α particle has been overlooked.

According to Rutherford, the number of α particles emitted per second by a gram of pure radium is $2{\cdot}5\times10^{11}$. Of these particles, one-quarter comes from each of the four elements Ra, RaEm, RaA, RaC. The particles from these four elements are emitted with velocities $0{\cdot}82\ V_0$, $0{\cdot}87\ V_0$, $0{\cdot}90\ V_0$, $1{\cdot}00\ V_0$ respectively, where V_0 is $2{\cdot}6\times10^9$ cm./sec.; they all cease to produce ionisation when their velocity is $0{\cdot}43\ V_0$. Hence the loss of kinetic energy of all the α particles emitted from one gram of radium in passing over their ionising ranges is

$$\frac{2{\cdot}5\times10^{11}}{4}\times\tfrac{1}{2}m\times\{(0{\cdot}82)^2+(0{\cdot}87)^2+(0{\cdot}90)^2+1^2-4\times(0{\cdot}43)^2\}(2{\cdot}6\times10^9)^2=m\times5{\cdot}3\times10^{29},$$

where m is the mass of an α particle.

At the same time, it is known that one gram of radium gives out 105 gram-calories per hour (mean value), or $1{\cdot}22\times10^6$ ergs per second. If we may identify this quantity of heat energy with the kinetic energy lost by the α particles in ionisation we have

$$m\times5{\cdot}3\times10^{29}=1{\cdot}22\times10^6$$

or

$$m=2{\cdot}3\times10^{-24}.$$

The ratio e/m for the α particle is $1{\cdot}56\times10^{14}$ electrostatic units. The two most probable theories of the nature of the α particle are (1) that it consists of an atom of helium carrying a charge 2ϵ, where ϵ is the electronic charge $3{\cdot}4\times10^{-10}$, and (2) that it is a molecule of hydrogen carrying a charge ϵ. On the hypothesis (1) the mass of the particle is $4{\cdot}26\times10^{-24}$; on the hypothesis (2) it is $2{\cdot}13\times10^{-24}$. The calculation given indicates that (2) is correct, and explains the failure of Greinacher and Kernbaum to obtain helium from the α rays of polonium (*Phys. Zeit.*, 1907, p. 339).

If it be assumed that the whole of the kinetic energy of the α particles, and not only that part of it which is spent in ionisation, appears as heat energy, the value for m is found to be

$$1{\cdot}78\times10^{-24}.$$

I have thought it best to give the maximum estimate of that quantity which can be attained by this method.

NORMAN R. CAMPBELL.

Trinity College, Cambridge, June 3.

The "Renal-portal System" and Kidney Secretion.

I RECENTLY published a short paper (Proc. Zool. Soc., 1906) on the significance of the so-called "renal-portal system" found in most of the lower Vertebrata. In this paper I advanced strong reasons for supposing that the "renal-portal system," or, as I prefer to call it, renal cardinal meshwork, is non-excretory in nature. I showed that, both developmentally and structurally, there was every reason to doubt whether the renal cardinal meshwork takes any part in the formation of the plexus of blood-vessels which surrounds the urinary tubules (although, of course, these are connected with each other), and that therefore the blood apparently supplied to the kidney by the "renal-portal" (post-renal) vein is in all probability not utilised in the production of the kidney secretion. This conclusion, opposed to that held by most physiologists and morphologists, I supported by citing the physiological experiments of Nussbaum (*Pfluger's Archiv*, xvi., xvii., 1878; *Anat. Anzeig.*, i., 1886) and Beddard (*Jour. Physiol.*, xxviii., 1902), which afforded valuable confirmation. These experiments, as is well known, proved that after the arterial supply of the frog's kidney had been eliminated all secretion immediately stopped, notwithstanding the facts that the "renal-portal" circulation was still in full swing and that powerful diuretics were employed. The sole objection to regarding these experiments as conclusive was that, in consequence of the kidney being deprived of oxygenated blood, the tubular epithelium had degenerated, and was therefore not in a condition to secrete. While recognising this objection, yet for the other reasons which I had already advanced I ventured to maintain that, even if the blood in the post-renal vein could be artificially oxygenated, no secretion would occur.

Unfortunately, I was not aware of more recent physiological work on this subject when I made this last suggestion. Since then, however, Prof. Halliburton has kindly directed my attention to the papers of Bainbridge and Beddard (*Biochemical Journal*, i., 1906) and Cullis (*Jour. Physiol.*, xxxiv., 1906), in which the reverse result has been obtained; that is to say, according to these later experiments, a secretion can be obtained from the "renal-portal" circulation provided that the tubule epithelium is maintained in a healthy condition by means of a sufficient supply of oxygen, and that powerful diuretics like urea and phloridzin are employed. This result at first sight appears to be contradictory of my previous conclusion and confirmatory of the generally accepted "portal" theory of the renal cardinal meshwork, but it is the object of these remarks to show that such is, after all, not necessarily the case.

In the first place, these recent experiments have clearly shown that the "renal-portal" circulation will not yield the slightest secretion in the absence of powerful diuretics; in other words, the result obtained by Bainbridge, Beddard, and Cullis is at best an abnormal one. Under more normal conditions, *i.e.* in the absence of diuretics, with a healthy tubule epithelium and with the "renal-portal system" alone working, no secretion whatever occurs.

Secondly, the very fact that when the venous blood contained in the renal cardinal meshwork alone "supplies" the kidney, the tubule epithelium degenerates, proves that in the normal living animal this blood is not in contact with the tubules, *i.e.* does not take part in the formation of the blood-plexus surrounding the tubules, since, as the experiments prove, these latter require the oxygenated blood derived from the renal arteries in order to live and much more to secrete.

Thirdly, it must be remembered that in the experiments of Bainbridge, Beddard, and Cullis, the elimination of the