St. Patrick's College, Maynooth,
16th Dec. 1897.

Dear Sir,

I beg to thank you very sincerely for the trouble you have taken to answer my questions. I was pleased to learn that you do not consider the argument in the printed pages in any way ridiculous. I had, and still have, grave doubts as to its validity; though, if the medium were absolutely continuous, my difficulties would be to a large extent removed. But I am glad the argument is not plainly invalid to a man of science.

Will you allow me to say a word as to the meaning I attach to the terms "density" and "~~inertia~~" ? I am tempted to do so, not in the least with a desire that you should reply to my observations, but merely to tell you why I was led to attach to these words the meaning I do ascribe to them.

"friction"

1. As to "density" and "inertia", I was and am under the impression that the tendency of modern science is, to regard all kinds of matter as absolutely, and therefore equally, inert. If, therefore, inertia were the same as density, we should say that all material substances are equally dense. We do not say this. Why ? Is it because density is not precisely the same as inertia, or because all kinds of matter are not equally inert ?I am afraid to take the latter alternative.

Take the matter in my way, however. The smaller the amount of mass there is packed within a given volume, the fewer must be the number of molecules to be moved within the ~~area~~ volume, and therefore the easier to communicate motion to the mass. Hence, it is easy to communicate motion to a mass in proportion to the paucity of molecules in a given volume. If, then, we understand by inertia the capacity to resist ~~it~~ motion,- and this seems to be the true meaning of the term,- the more closely matter is packed within a cubic inch, the greater is its inertia. In other words, inertia, in the only sense in which it varies in the various forms of matter, is in direct proportion to the closeness with which the molecules are packed. Or, a mass grows inert as it grows dense, in the sense which I have been accustomed to attach

However, this shows only of what, about the use of the term, density, ought it to be, not about it is.

to the latter term.

This would seem to indicate that, though density may be measured by inertia, the meaning attachable to the two terms is not quite the same; density referring to closeness of grain, so to speak, inertia to power of resisting movement.

As to the argument from the facility with which air can be moved with rapidity,—as you point out, it does not seem to prove that the density of ether is but small. The argument supposes the ether in and near the air to move with it. It is, however, much more likely that the molecules of air move through the ether, disturbing the latter only to a comparatively small degree.

2. This brings me to "friction". The essential notion of the term, as I conceive it, is, the conversion by resistance of molar movement into molecular. This necessarily leads to heat; still the friction is prior to and productive of the heat motion.

If this be the true meaning of friction, the ether could be frictionless only if it offered no resistance to a body moving through it. I am not sure that this would not be so, if the moving mass were already immersed in the medium and in motion, and if moreover the ether were absolutely continuous, so that motion would take no time to travel within its own mass. But I cannot see how the ether could be without friction,- as Professor Lodge wishes us to represent it to our imaginations,- and at the same time suffer resistance from electrical conductors. If bodies moving through ether suffer no resistance, neither should ether moving through these bodies.

I hope I am not boring you; and I do not want you to reply to this letter, which is primarily intended to thank you for your trouble. I would also like to express a hope that you will not consider the notions expressed in this letter too dogmatic. I am a metaphysician and theologian rather than a physicist; but when we all come to draw conclusions from ascertained facts,- as even physicists must, when they wish to philosophize,- we must necessarily dogmatize in some sense. We should, of course, avoid being too positive. In discussing such questions as the nature of energy,- whether of heat, light, electricity, chemical affinity, or in any other form,- I fear we must be content to take facts merely as a basis, and then advance into the region of inference, metaphysics, or, if you will, of dogmatism.

With sincere thanks and kind wishes,

I am, very faithfully yours
Walter McDonald.