CORRESPONDENCE.

The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.]

To the Editor of SCIENCE.

The "Ononid" meteors were watched this morning from 12.20 to 3.05 by four observers. The shower seemed quite abundant, 190 meteors being mapped during the time of observation. About one-half of these undoubtedly belonged to a common system. The radiant point as deduced from these, and which, considering their number cannot be greatly in error, was R. A.—86°, Dec. + 16° which brings it just outside the limits of the constellation Onon. No stationary meteors were observed and but very few with short paths near the radiant point. This may be due to the fact that they were so faint (mostly about equal in brightness to a fourth magnitude star) that the short paths were not sufficiently conspicuous to call our attention to them. An auroral light was visible in the north and east during the early part of the watch. Chambers gives 85°, + 16 as the radiant point, and adds that Tupman makes it 90°, + 11.

Respectfully,

ISAAC SHARPLESS.

HAVERFORD COLLEGE OBSERVATORY, PA., 10*mo*, 19*th*, 1881.

DR. H. RAYMOND ROGERS AND HIS CRITICS.

To the Editor of "SCIENCE."

Prof. Merriam, in your journal, page 495, writes as follows: "I do not like to see so great an authority as Faraday misunderstood, as he evidently is by your correspondent on page 459 of your journal, and that, too, in a way which he took particular care to caution against—as to the law of gravitating action. That it acts inversely as the square of the distance he fully believed and admitted; or, to use his own words, 'I know it is so.'"

The quotation objected to was made verbatim from Faraday's writings, and the sentiments contained therein were frequently expressed by him, and with emphasis. In the work entitled "Correlation and Conservation of Force," page 363, is an essay by Faraday entitled "The Conservation of Force," in which we read the following, viz.: "I believe I represent the received idea of the gravitating force aright in saying that it is a simple attractive force exerted between any two or all the particles or masses of matter, at every sensible distance, but with a strength varying inversely as the square of the distance. The usual idea of the force implies *direct* action at a distance: and such a view appears to present little difficulty except to Newton, and a few, including myself, who in that respect, may be of like mind with him. This idea of gravity appears to me to ignore entirely the principle of the conservation of force; and by the terms of its definition, if taken in an absolute sense, '*varying* inversely as the square of the distance,' to be in direct opposition to it." Again, in the same essay, page 366, "the assumption which we make for the time with regard to the nature of a power (as gravity, heat, etc.,) and the form of words in which we express it, that is, its definition, should be consistent with the fundamental principles of force generally. The conservation of force is a fundamental principle; hence the assumption with regard to a particular form of force ought to imply what becomes of the force when its action is *increased* or *diminished*, or its *direction changed;* or else the assumption should admit that it is deficient on that point, being only half competent to represent the force; and, in any case, should not be opposed to the principle of conservation. The usual definition of gravity as *an attractive force between the particles of matter varying inversely as the square of the distance*, whilst it stands as a full *definition* of the power, is inconsistent with the principle of the conservation of force."

Faraday is here laboring to show the incompetency of that definition *alone*. He thinks the natural philosopher ought to look for effects and conditions as yet unknown; and so virtually calls aloud for some one to fill up what to him appears a serious deficiency. He called the old definition only a *half*-assumption, and felt the necessity of some enlargement of it, that it might stand secure. He says: "the half-assumption is, in my view of the matter, more dogmatic and irrational than the whole, because it leaves it to be understood that power can be created and destroyed almost at pleasure."

Faraday called for, what we believe, the electric theory amply supplies. Not only so, but he also indicated this very source of supply. For example, a "grain of water" having a given force of gravity has also "electric relations equivalent to a very powerful flash of lightning." He says, "It may, therefore, be supposed that a very large apparent amount of the force causing the phenomena of gravitation, may be the equivalent of a very small change in some unknown condition of the bodies, whose attraction is varying by change of distance. For my own part, many considerations urge my mind toward the idea of a cause of gravity, which is not resident in the particles of matter merely, but constantly in them, and all space."

We have been led to think that it was not impossible to *find* such "cause of gravity, not resident in the particles of matter merely," but which by means of a "very small change in some [formerly] unknown condition of the bodies," shall bring the whole subject of gravitation out from the shadowy realms of darkness into abiding sunlight.

In brief, Faraday insists that the totality of the force of gravity is not expressed by the definition that "gravity acts directly as the mass and inversely as the square of the distance." Indeed, he says as pithily as when he uttered your correspondent's quotation, "I know it is so." "That the *totality* of a force can be employed according to that law *I do not believe!*"

It might, by the way, be of interest to learn a little more definitely as regards what it was that Faraday knew was so. The following are his words: "That the result of one exercise of a power may be inversely as the square of the distance I believe and admit; and I know it is so in case of gravity." The same sentence, however, continues: "but that the *totality* of a force can be employed according to that law I do not believe either in relation to gravitation or electricity or magnetism, etc."

It may be asked what can be correctly known of the action of electricity or magnetism where the item *polarity* is left out? "What I object to," says Faraday, "is the pretence of knowledge which the definition sets up when it assumes to describe, not the partial effects of the force, but the nature of the force as a whole."

Satisfied with the old definition as your correspondent may be, Faraday looked for a "missing link." We may say that he pointed it out in saying:—"when we remember that the earth itself is a magnet, pervaded in every part by this mighty power, universal and strong as gravity itself, we cannot doubt that it is exerting an appointed and essential influence over every particle of matter, and in every place where it is present. What its great purpose is seems to be looming up in the distance before us:—the clouds which obscure our mental sight are daily thinning, and I cannot doubt that a glorious discovery in natural knowledge and in the wisdom and power of God in the creation is awaiting our age."

I would conclude this part of my reply to your correspondent, with the recommendation that he study Faraday, for "I do not like to see so great an authority as Faraday misunderstood."

Again, as regards the earth's return from aphelion to perihelion:—

It is admitted that my reply (p. 459) to Mr. Hendricks