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Ether, Materia subtilis,[1] or atherial medium[2]

(1.) of Newton — (2.) of Des Cartes —

The Atmosphere wc surrounds this small Planet on wc we live is estimated to be abt 45 miles high; and all the space beyond this comparatively small ball of Earth, all the way to the Sun & to the other Plants, nay to the fixed stars themselves is the region of dreary nothing, according to the opinion of some, a space absolutely void of any thing material. But when we consider that there are thousands of thousands of suns, multiplied without end, attended by as many worlds; and that all these together form but one flower in the Garden of the Deity; can we, on a moments reflection, believe that the space between us and them is totally void of matter? The mind recoils with a sort of horror at the idea that the largest part of the Uni-verse should be the region of dreary nothing.

The first philosophers that ever have appeared in the world have rejected the idea of a vaccum, & have filled the universe with a species of matter, wc Des Cartes called the materia subtilis & Sir I. Newton a subtile spirit, & sometimes he called it the atherial medium.

See Rees Cyclop. art. Ether.

Some suppose it to be of so subtle & penetrating a nature, as to pervade the air, & other bodies, & possess the pores and intervals thereof. Some suppose it to be a fifth element, of a purer & more refined & spirituous a nature yn the substances about our Earth; and void of the common properties of matter, as gravity.

Although we cannot prove the existence of such a subtle spirit or æther, yet there are many considerations that render it highly probable.—

" That there is an unknown something wch remains behind when the air is taken away, appears from certain effects wch we see produced in vacuo." Heat says S. I Newton, " is communicated through a vaccum, almost as " readily as through air!" But such communication cannot be without some interjacent body, to act as a medium. And such body must be subtle enough to penetrate the pores of glass, as a glass vessel is that part of the air-pumps, where the vaccum, as it regards air is made. If this subtle spirit penetrates glass, we may well conclude that it penetrates the pores of all other bodies, & consequently is diffused through all the parts of space.

" Sir Isaac Newton supposes this subtle space or æther to be rarer in the pores of bodies ypn in open spaces, & even rarer in small pores & dense bodies, ypn in large pores & rare bodies; and also, that its density increases in receding from gross matter, so as to be greater, e.g. at the $\frac{1}{100}$ of an inch from the surface of any body ypn at the surface".

Newton infers that this æthereal medium is not only rarer & more fluid ypn air, but exceedingly more elastic & active: in virtue of which properties, he shews, that a great part of the phænomena of nature may be produced by it.

The elastic force of this subtle medium, in proportion to its density, must be, by estimation, says Sir Isaac 700,000 times greater than the elastic force of the air in proportion to its density.
To the action of this ætherial medium Newton ascribes the attractions of gravitation & cohesion; the attraction & repulsion of electrical bodies; the elastic force of the air; & of the nervous fibres; and the emissions, refractions, reflection & other phenomena of light, and the effects & the communications of heat; as also sensation & muscular motion. In fine, this ætherial medium spirit, or æther seems the Primum mobile, the first source or spring of physical action in our system; and the existence of such a subtle fluid has been almost universally allowed; and its importance & utility has been very generally acknowledged." (see Cyclop. æther.)

Let us see how near this Newtonian doctrine of an ætherial medium will carry us to a just conception of Fire. [From Lavoisier.]

Every ~~body~~ one knows that all bodies whether solid or fluid is augmented in all its dimensions by any increase of its sensible heat.

When we have heated a solid body to a certain degree, and have thereby caused its particles to seperate from each other, if we allow the body to cool, its particles again approach each other, in the same proportion in which they

they were seperated by the encreased temperature; the body returns by the same degrees of expansion through wc it before extended; and, if brought back to the same temperature wc it possessed at the commencement of the expt it recovers exactly the same dimensions wc it formerly occupied; but still its particles do not touch each other. What hinders them? They are prevented by that ætherial medium, or igneous fluid, or elastic "atmosphere" of fire, if we may use such a term, wc surrounds every particle of mr in the Universe; the contraction of which elastic fluid consolidates metals, & its expansion melts them.

Lavoisier. Vol. 1.

As the particles of bodies are impelled by heat to seperate from each other, there would be no solidity in Nature, unless these particles were held together by some other power wc tended to unite them, or as Plato says chain them together. This power is named attraction.

Thus the (original permanent) particles of all bodies may be considered as subject to the action of two opposite powers, viz the repulsive power of fire; & the approximating power of attraction. So long as the attractive force remains stronger, the body continues in a state of solidity; but if heat has so far removed these particles from each other, as to place them beyond the sphere of attraction, they lose the cohesion they had wth each other, & the body melting, ceases to be solid. Water

Water gives a regular & constant example of these facts: while its temperature is below 32°. of Fah.t it remains solid & is called Ice: above that degree of temperature, its particles being no longer held together, by reciprocal attraction, it becomes liquid. And when we raise its tem-perature above 212° its particles, giving way to the re-pulsion caused by the heat, assume the state of vapour or gas, & the water is changed into what is called an aeriform fluid."

The same may be assumed of all bodies in nature: they are either solid or fluid; or in a state of aeriform gas or vapour, according to the proportion w.c takes place between the attractive force inherent in their particles; and the repulsive power of the heat acting upon them; or, in other words, in proportion to the degrees of heat to which they are exposed.

It is difficult to comprehend these phenomena, says that excellent French chemist Lavoisier, to whom we are indebted for the doctrine here advanced) without admit-ting them as the effects of a real & material substance, or very subtle fluid, w.c insinuating itself between the particles of bodies, seperates them from each other. Lavoisier called it the igneous fluid, & the matter of heat; and afterwards for good reasons, called it Caloric; by w.c term chemists now mean that exquisitely elastic fluid w.c

wc causes heat. In fine Fire or Caloric is the repulsive cause (whatever that maybe) wc seperates the particles of matter from each other.

Whether Light be a modification of caloric, or if caloric be a modification of Light we are unable to determine; for, as Dr Franklin observes, when treating on this abstruse subject — "we are much in the dark respecting light." They are always treated seperately in books of chemistry. The light of the moon re-flected on white paper does not occasion heat; and yet they have certain qualities in common; and, in certain circumstances, combine with other bodies almost in the same manner, & produce, in part the same effects.

Difficult as it is to determine the idea affixed to the word caloric it is much more difficult to give a just idea of the manner in wc caloric acts upon other bodies, because this subtle fluid penetrates through the pores of all known substances, & there is no vessel through wc it cannot escape. It is difficult to acquire a knowledge of things that are not objects of sight.

Caloric not only surrounds the particles of all bodies, on every side, but fills up every interval wc the particles of bodies leave between each other.

We can illustrate this idea, by a very simple apparatus. Let this Tumbler be filled with musquet balls, or marbles, among wc we will pour a quantity of fine sand; this, insinuating

itself into the intervals between the marbles, will fill up every void. The balls, in this comparison, are to the sand exactly in the same situation as the particles of bodies are with respect to the caloric, only with this difference, that the balls touch each other, whereas the particles of matter are not in contact; but are kept at a smaller or greater distance by this igneous fluid, or fiery spirit, commonly called fire, but philosophically denominated caloric.

But if instead of spherical balls we use use solid bodies of 6, or 8 sides, or any other regular figure, for example Cuboid, what will follow? Why the capacity of the intervals, or spaces between them will be lessened, & consequently they will no longer contain the same quantity of sand. — Now the same thing takes place with respect to natural bodies. Different bodies have diff.t capacities for containing the matter of heat.

This may be farther illustrated by attending to the circumstances of diff.t kinds of wood soaked in water. Suppose pieces of wood of a foot square be soaked in water, the fluid gradually insinuates itself into their pores & the cubes of wood are encreased both in weight & size; & every species of wood will imbibe a different quantity of water; the lighter & more porous woods will admit a larger, while the compact & closer grained wood will admit a less quantity. — Now the same circumstances take place with bodies that are immersed in caloric. While discussing this subject, can we keep out of our minds the "Anima Mundi," of the Stoicks? —

Zeno, father of the Stoic philosophy conceived heat to be matter.

We are indebted to that celebrated French Philosopher Lavoisier for the best explanation of this doctrine of Heat or caloric. He lays it down as an universal maxim that "without motion, there is no sensation". There is something cheerful & enlivening in this short maxim — while, "as still as the grave" conveys an idea that is chilling & shocking! Shakespear doubtless felt this horrible idea when he said

"To die, and go we know not where!
"To lie in cold obstruction, & to rot;
"This sensible warm motion to become
"a kneaded clod! (measure for measure)

In saying therefore that without "motion there is no sensation", we concentrate an host of facts. — "Organization says Lavoisier, sensation, spontaneous motion, & all the operations of life exist only at the surface of the earth, & in places exposed to the influence of Light (& caloric), i.e of motion. Without Light, (& its concomitant heat) Nature itself w.d be lifeless & inanimate. By means of Light, the benevolence of the DEITY hath filled the surface of the Earth with organization, sensation and Intelligence!"