

their decreasing refrangibility and increasing power, these having been traced far beyond the prismatic spectrum in an invisible state; that as their density gradually decreases, their energy at last vanishes, till at length the thermometrical spectrum, as the Doctor is willing to call it, becomes wholly imperceptible. Hitherto the effects of these heating rays have been observed as far as one inch and a half from the confines of the red ray.

If this be a true account of solar heat, (says our author at the close of his paper,) it remains only for us to admit, that such of the rays of the sun as have the refrangibility of those which are contained in the prismatic spectrum, by the construction of the organs of sight, are admitted under the appearance of light and colours; and that the rest, being stopped in the coats and humours of the eye, act upon them, as they are known to do upon all the parts of our body, by occasioning a sensation of heat.

*Experiments on the solar, and on the terrestrial Rays that occasion Heat; with a comparative View of the Laws to which Light and Heat, or rather the Rays which occasion them, are subject, in order to determine whether they are the same, or different.* By William Herschel, LL.D. F.R.S. Read May 15, 1800. [*Phil. Trans.* 1800, p. 293.]

In the prefatory part of this paper, the author found it necessary to limit the sense he affixes to the word *heat*; and after excluding the late terminology of *latent*, *absolute*, *specific*, *sensible* heat, the *matter of heat*, *caloric*, and even *radiant heat*, which last, however, comes nearest to the expression he has adopted, he desires to be understood, that, in speaking of *rays which occasion heat*, he does not mean that those rays themselves are heat, but that he here considers heat merely as the effect of a cause, the nature of which is no part of his present inquiry.

Having thus determined the subject of his investigation, the Doctor distinguishes heat into six different kinds; whereof three are solar, and three terrestrial. These, however, are reducible into three general divisions, each of the solar and terrestrial kinds resembling each other respectively. The first is the heat produced by luminous bodies, whether by the sun or by terrestrial flames. The second comprehends the heat of coloured radiants, such as that of the sun separated by a prism, and that of culinary fires openly exposed. And the third relates to heat from radiants, where neither light nor colour can be perceived; such as the heat of invisible solar rays, refracted by a prism, which have been the subject of a former paper; and the terrestrial heat from fires inclosed in stoves, and from metals heated short of the lowest degree of incandescence.

The chief object of the present inquiry being to give a comparative view of the operations that may be performed on the rays that occasion heat, and of those which we know to have been effected on the rays that occasion light, a short detail is given of the principal facts

respecting the latter, which not only are well known to be founded, but are also best calculated to elucidate the comparison. These are the seven following:—1. Light, both solar and terrestrial, is a sensation occasioned by rays emanating from luminous bodies; 2. These rays are subject to the laws of reflection; 3. They are refrangible; 4. They are of different refrangibility; 5. They are liable to be detained by different diaphanous bodies; 6. They are liable to be scattered on rough surfaces; and 7. They have hitherto been supposed to have a power of heating bodies, which however remains as yet to be examined.

The similar propositions respecting heat which the Doctor intends to prove, are as follows:—1. Heat, both solar and terrestrial, is a sensation occasioned by rays emanating from *candent* substances; 2. These rays are subject to the laws of reflection; 3. They are refrangible; 4. of different refrangibility; 5. liable to be detained in their passage through other bodies; 6. liable also to be scattered on rough surfaces; and lastly, They may be supposed, when in a certain state of energy, to have a power of illuminating objects; which last, however, remains as yet to be examined.

The paper before us is limited to the experiments on the three first of the above-mentioned comparative propositions. They are twenty in number, of which the ten first relate to the *reflection*, and the ten last to the *refraction* of these rays, under all the variety of circumstances deducible from the different kinds of heat above enumerated; to which are added, some attempts to produce a condensation of heat independent of light, by spherical mirrors and lenses. Such mirrors and lenses, together with accurate thermometers, were the instruments used in these experiments, of which those on invisible solar heat, and invisible culinary rays, are perhaps the most striking, as they serve to corroborate the theory laid down by the Doctor in a former paper concerning the existence of such heat and rays independent of light.

It being impracticable to epitomize the ample account of these experiments given in the paper, we must content ourselves with observing in general, that all their results fully evince the truth of the second and third propositions above laid down, viz. that the rays which occasion heat, both solar and terrestrial, in all their different kinds, and under every variety of circumstances that could be devised, are subject to the laws of reflection and refraction.

The same results also convey sufficient evidence of the radiant nature of light; and hence equally prove the first of those propositions. The three following ones, viz. the fourth, fifth, and sixth, are reserved for a future communication; where the author proposes likewise to enter into a discussion concerning the seventh or last of them, relating to the power of heating and illuminating.