

envelope must be of a thickness different from that of the polar, *density for density*, so that a different obstacle must be thereby opposed to the escape of heat from the equatorial and the polar regions of the Sun." Arago is engaged at the present moment in a series of experiments, by which he purposes to test not only his own views, but also to reduce the results of observation to accurate numerical relations.

A comparison between solar light and the two most intense kinds of artificial light which man has hitherto been able to produce, yields, according to the present imperfect condition of photometry, the following numerical results: Fizeau and Foucault found, by their ingenious experiments, that Drummond's light (produced by the flame of the oxyhydrogen lamp directed against a surface of chalk) was to the light of the Sun's disk as 1 to 146. The luminous current, which in Davy's experiment was generated between two charcoal points by means of a Bunsen's battery, having forty-six small plates, was to the light of the Sun as 1 to 4.2; but when very large plates were used, the ratio was as 1 to 2.5, and this light was, therefore, not quite three times less intense than solar light.* When we consider the surprise still experienced at the circumstance of Drummond's dazzling light forming a black spot when projected on the Sun's disk, we are doubly struck by the felicity with which Galileo, by a series of conclusions as early as 1612,† on the smallness of the distance from the Sun at which the disk of Venus was no longer visible to the naked eye, arrived at the result that the blackest nucleus of the Sun's spots was more luminous than the brightest portions of the full Moon.

William Herschel, assuming the intensity of the whole light of the Sun at 1000, estimated the average light of the penumbrae at 469, and the black nuclei at 7. According to this estimate, which is certainly very conjectural, a black nucleus would yet possess 2000 times more light than the full

* Fizeau and Foucault, *Recherches sur l'Intensité de la Lumière émise par le Charbon dans l'Expérience de Davy*, in the *Comptes Rendus*, tom. xviii., 1844, p. 753. "The most intensely ignited solid (ignited quicklime in Lieutenant Drummond's oxyhydrogen lamp) appear only as *black spots* on the disk of the Sun when held between it and the eye." —*Outlines*, p. 36 (*Cosmos*, vol. ii., p. 325-326).

† Compare Arago's commentary on Galileo's letter to Marcus Welser, as well as his optical explanation of the influence of the diffuse reflected solar light of the atmospheric strata which covers the object seen in the sky upon the field of a telescope, as it were, with a *luminous veil*, in the *Annuaire du Bureau des Long.* for 1842, p. 482-487.