

order to bring them into harmony with the facts of modern society. The postulates selected are those referring to the transferability of labor and capital respectively.

After a short discussion of the reasons for the general neglect into which English political economy has of late fallen, in which he gives nearly all reasons except the right one, viz., that it is an outlived theory, the author proceeds to show that the Ricardian assumption of the easy and rapid transferability of labor and capital among various industries never has been true, and is not true now, though it may be true in the distant future. A more complete vindication of the justice of the attacks on Ricardo's system, so far as it is claimed to be a satisfactory explanation of our modern industrial economy, could scarcely be desired. Had Mr. Bagehot lived to finish the great work of which these essays were to form a part, it can scarcely be doubted that he would have followed out his premises to their legitimate conclusions, and finally have been found where he belonged,—among the opponents, instead of among the restaters, of 'orthodoxy.'

C. R.

TEMPERATURE OF THE MOON'S SURFACE.

PROFESSOR LANGLEY'S two most important discoveries—1°, that the greater part of the energy in the solar spectrum is way below the visible red; and, 2°, that our atmosphere is more and more transparent to radiant energy the greater its wavelength—promise to bear fruit in many directions. In his paper on the temperature of the surface of the moon,¹ one of their applications is shown in the complete upsetting of the long-cherished idea that the temperature of the moon's surface rises to 200° or 300° F. during the lunar day, and falls about as far below zero in the lunar night. First enunciated as a theory by Sir John Herschel, the only experimental evidence upon which it has rested has been the observations of lunar radiation by the present Earl of Rosse, to which Professor Langley takes no exception, so far as the experimental results are concerned, but from their interpretation by Lord Rosse, he entirely dissents. This interpretation rests upon the assumptions, 1°, that solar radiation is principally confined to luminous vibrations; 2°, that about 92 per cent of these are transmitted by glass; and, 3°, that only 1.6 per cent of the obscure rays are transmitted by glass. The first has already been shown

to be entirely wrong, and, when it is remembered that Professor Langley found over two-thirds of the total energy in the solar spectrum, from a glass prism, to lie below the visible red, nothing further need be said as to the non-conclusiveness of any deductions from the above assumptions.

Professor Langley's observations on Mt. Whitney lead him to the conclusion that, were it not for our atmosphere, the surface of the earth, even under continuous direct sunshine, would be at a temperature of only about 48° C. above that of surrounding space (whatever that may be), at any rate low enough to freeze every thing up solid, perhaps even the gases; and he concludes that the moon is in this condition unless it has an appreciably absorbing atmosphere, of which there are only some uncertain suggestions at present.

Attacking the problem entirely anew, he speaks of its importance as follows:—

"The amount of heat received from the moon, and the dependent question as to the temperature of the lunar surface, are subjects of greater interest to us than might at first appear. They are even ones in which we may be said to have a material concern, for, until we know the temperature which an airless planet would attain in the sun's rays, we can have no accurate knowledge of the extent to which the atmosphere of our own planet contributes to its heat, nor of some of the most important conditions of our own existence."

Professor Langley describes important improvements in the galvanometer used with his bolometer, so that with the combination of the two he is now able, when the needle is damped to a period of 10s., to make 1mm. on the scale correspond to a current of only 0.000,000,001,3 of an ampère, or indicate a difference of temperature of only 0°.000,016 C. As regards precision of measurement, the probable error of a single observation is only about 2 per cent of the total amount of lunar radiation, while in Lord Rosse's work the probable error of *the mean of a series of 10 observations* was 19 per cent, thus giving one of the former a weight equal to several hundred of the latter, to say nothing of its far greater freedom from constant errors.

With this apparatus, and with all the other refinements and precautions against error which invariably accompany all of Professor Langley's work, he has been making the following investigations:—

1°. Direct measurement of lunar heat compared with solar. 2°. Comparison of moon's heat with that of Leslie cube (hot water). 3°. Transmission of lunar heat by the earth's atmosphere. 4°. Comparative transmission of glass for lunar and

¹ Memoirs of the National academy of sciences, vol. iii, pt. i, 2d memoir. On the temperature of the surface of the moon. By S. P. LANGLEY. Washington, Government, 1885. 4°.

solar heat. 5°. Observations during a lunar eclipse. 6°. Formation of a lunar heat spectrum.

We can only summarize the results, and they are best given in his own words: "While we have found abundant evidence of heat from the moon, every method we have tried, or that has been tried by others, for determining the character of this heat, appears to us inconclusive; and, without questioning that the moon radiates heat earthward from its soil, we have not yet found any experimental means of discriminating with such certainty between this and the reflected heat that it is not open to misinterpretation. Whether we do so or not in the future will probably depend on our ability to measure by some process which will inform us directly of the wave-lengths of the heat observed."

Were this all, it would be a somewhat discouraging ending, but the best and most important part is a note added February, 1885, which we quote in full:—

"Since the above paragraph was written, we have succeeded in obtaining measures with rock-salt prisms and lenses in a lunar heat spectrum. These difficult measures must be repeated at many lunations before complete results can be obtained; but, considering their importance to the present subject, we think it best to state now in general terms, and with the reserve due to the necessity of future experiment, that they indicate two maxima in the heat curve,—one corresponding within the limits of errors of observation to the solar curve maximum; the second, indefinitely lower down in the spectrum, corresponding to a greater amount of heat at a lower temperature. Exactly what temperature this latter corresponds to, we have no present means of knowing. We have succeeded, however, in forming a measurable heat spectrum from the surface of a Leslie cube containing boiling water, and the maximum ordinate in the lunar heat curve appears to be below the maximum ordinate in the hot water curve. The inference from this is, of course, that the temperature of the lunar soil is, at any rate, below that of boiling water, and in an indefinite degree.

"We cannot close this note without calling attention to the remarkable fact that we here seem to have radiations from the moon of lower wave-length than from the sun, which implies an apparent contradiction to the almost universally accepted belief that the sun's emanations, like those from any heated solid body, include all low wave-lengths representing temperatures inferior to those certainly emitted."

Further comment is unnecessary. The novelty and importance of the above is self-evident.

H. M. PAUL.

ILLUSTRATIONS OF RECENT ITALIAN PSYCHOLOGY.

THE science of psychology is still somewhat in the position of the young man who has just passed his twenty-first birthday. While really entitled to all the rights and dignities belonging to any of the citizens of the republic of science, yet these privileges are accorded with somewhat of a reluctant spirit especially on the part of the older citizens, who seem rather startled at the notion of receiving, on terms of equality, so very youthful and so very presumptuous a candidate. But now that special professorships in this department have been instituted at several of our universities and colleges; now that the questions which it discusses find a hearing before appropriate sections of the great scientific associations (for it is scientific psychology alone that is meant); that special societies and journals are devoted to the encouragement of its progress; it may fairly be presumed that whatever of a protest to this reception still makes itself heard is only the echo of by-gone days.

While the greatest part of our experimental knowledge of mind is undoubtedly due to German writers and workers, France and Italy have also contributed much to raise the science to its present position. In France the *Revue philosophique*, of which M. Ribot, whose psychological works are well known to English readers, is the editor, pays special attention to the strictly scientific side of its domain. There has been founded, too, a society of physiological psychology, especially devoted to the consideration of experimental topics. In Italy the *Rivista sperimentale di freniatria*, edited by M. A. Tamburini, and the *Archivio di psichiatria*, etc., edited by M. Cesare Lombroso, devote much of their energies to another side of the subject. Both the writers just mentioned are deeply interested in the psychology of the criminal and other classes of defectives. The voluminous work of M. Lombroso (*Uomo delinquente*) is a standard in this line of research. The *Revue philosophique* for September enlarges the circle of readers of some of these researches, by presenting a summary of articles from the two Italian journals. In the hope of still further increasing the usefulness of these contributions to psychology, some account of them is given here.

M. Ferri has made a special study of the religious sentiment in the criminal class, and intends to publish a volume on this subject. He found, in a very large number of criminals examined, only a single one who did not believe in the existence of a God, and most of them belonged to the established church. Many of them are de-