

As soon as the result of these measurements was known, there was no longer any doubt as to the fact of the earth's oblateness, and the question only turned upon its quantity. Even before the return of the academicians, the Cassinis and Lacaille had measured the French arc, and found errors which subverted the former result, making the earth oblate to the amount of 1-168th of its diameter. The expeditions to Peru and to Lapland had to struggle with difficulties in the execution of their design, which make their narratives resemble some romantic history of irregular warfare, rather than the monotonous records of mere measurements. The equatorial degree employed the observers not less than eight years. When they did return, and the results were compared, their discrepancy, as to quantity, was considerable. The comparison of the Peruvian and French arcs gave an ellipticity of nearly 1-314th, that of the Peruvian and Swedish arcs gave 1-213th for its value.

Newton had deduced from his theory, by reasonings of singular ingenuity, an ellipticity of 1-230th; but this result had been obtained by supposing the earth homogeneous. If the earth be, as we should most readily conjecture it to be, more dense in its interior than at its exterior, its ellipticity will be less than that of a homogeneous spheroid revolving in the same time. It does not appear that Newton was aware of this; but Clairaut, in 1743, in his *Figure of the Earth*, proved this and many other important results of the attraction of the particles. Especially he established that, in proportion as the fraction expressing the Ellipticity becomes smaller, that expressing the Excess of the polar over the equatorial gravity becomes larger; and he thus connected the measures of the ellipticity obtained by means of Degrees, with those obtained by means of Pendulums in different latitudes.

The altered rate of a Pendulum when carried towards the equator, had been long ago observed by Richer and Halley, and had been quoted by Newton as confirmatory of his theory. Pendulums were swung by the academicians who measured the degrees, and confirmed the general character of the results.

But having reached this point of the verification of the Newtonian theory, any additional step becomes more difficult. Many excellent measures, both of Degrees and of Pendulums, have been made since those just mentioned. The results of the Arcs<sup>41</sup> is an Ellipticity of 1-298th;—of the Pendulums, an Ellipticity of about 1-285th. This difference

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<sup>41</sup> Airy, *Fig. Earth*, p. 230.