

**MEMOIR ON A NEW AND CERTAIN
METHOD OF ASCERTAINING THE
FIGURE OF THE EARTH BY MEANS
OF OCCULTATIONS OF THE FIXED
STARS; PP. 1 - 42**

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Memoir on a New and Certain Method of Ascertaining the Figure of the Earth by Means of Occultations of the Fixed Stars; pp. 1 - 42 by A. Cagnoli

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A. CAGNOLI

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MEMOIR

ON

A NEW AND CERTAIN METHOD

OF ASCERTAINING

THE FIGURE OF THE EARTH

BY MEANS OF

OCCULTATIONS OF THE FIXED STARS.

By A. CAGNOLI.

WITH
NOTES AND AN APPENDIX
By FRANCIS BAILY.

LONDON:

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not without hope and expectation that they may be eventually overcome: and that the mode herein proposed may at least be brought *in aid* of the other methods at present adopted for determining that difficult problem.

To the Memoir itself I have subjoined some Notes connected with the subject; which, however, may be distinguished from those of the Author by the addition of the letter B. And to the whole I have added an Appendix, wherein I have attempted to illustrate the views of the Author; and ventured to propose such methods as may best tend to carry his object into execution.

FRANCIS BAILY.

GRAY'S INN,
May 20, 1819,

. As the present Memoir is not published for *sale*, I shall be happy to furnish such persons, as may send their Cards for that purpose, with any number of copies they may require.

F. B.

MEMOIR

ON

*A new and certain Method of ascertaining
the Figure of the Earth.*

By A. CAGNOLI.

§ 1. THE truth of the Newtonian theory of universal gravitation is proved by the wonderful agreement in all the celestial phenomena, which have hitherto been submitted to the tests of calculation and of observation. There probably is not any astronomer of the present day who is not convinced that our planet is compressed, or flattened, at the poles, and protuberant at the equator. In fact, if we combine this theory of Newton with the hypothesis of the elliptical form of the earth, we shall find that the precession of the equinoxes and the nutation of the earth's axis are sufficiently accounted for. Other arguments indeed, in favour of the elliptical form, may be derived from the rotation of the earth, which is now generally admitted :

and others again from the differences in the length of the pendulum vibrating seconds in different latitudes. Still however we want some theory of the internal density of the earth; which, it is feared, will ever remain hid from human investigation. But if, to the want of this essential knowledge, we add the irregularity of the figure of the earth, as shown by the measurements of the degrees on its surface; if, to the doubts which some persons may still entertain of the truth of the compression of the poles*, we add the discordant opinions as to the quantity of that compression; we may surely assert that it will be no small advantage to point out a method (independent of all hypothesis) for determining, with facility and with the greatest precision, the differences between the terrestrial radii at an indefinite number of points on the earth's surface.—Such indeed is the object of the present memoir.

§ 2. It has always been said, when speaking of the compression or flattening of the poles of the earth, that the *Parallax of the Moon* would afford the best means of ascertaining it; provided the variations, arising therefrom, were of sufficient magnitude to be observed with perfect accuracy. But, since, by supposing this compression not to exceed $\frac{1}{100}$ of the semidiameter (which is the most received opinion at the present day) there would be

* See Lorgna "Principi di Geografia &c." § 31.

a difference of not more than $9''$ between the moon's parallax at the equator, and her parallax at a high latitude, for instance 60° ; so indeed it is but too true that a difference so small might be easily concealed under the possible errors of observation. It was, on this account, that Manfredi and Maupertuis in vain suggested the determination of the compression by direct observations of the moon's parallax: nor has any advantage been hitherto obtained by this method.

§ 3. But this is not the only instance in which a quantity, extremely minute on one side, has been found to produce effects that are quite discernible on the other. The attention of the observer should be directed to those points where they are most sensible. This has been the object of my research; and I hope not entirely without success. For, there are circumstances in which scarcely a *second* in the parallax may cause a difference of 15, 20, or 30 seconds of time, or even more, in the duration of the occultation of a star by the moon. But, occultations, more particularly when the immersions take place behind the dark limb of the moon, can easily be observed without committing an error of a single second of time*: so that opportunities

* The duration of an occultation cannot probably be so well observed when the immersions take place behind the dark limb of the moon, as when they take place behind the illuminated side; since the instant of *emersion* cannot be so well ascertained. B.