tz r2 — ? ’ . Therefore the attraction of the two rings is 2c^7×r—χ2×PEi + χl ×\*∙ But PE2 = POz— OE2, ~ *dz — (rt —* x2) = *d^l —* r2 ⅛ *xl.* Therefore the attraction of the two rings is

2 c Γ⅛^× r'i ~ χi X *r\*+ 2 χ2 x » = 2 c rd4\**

• T V 7 -. τ — *e*

*rzd2x — r4 X* -⅛- 2 r2 *x2 X — d x1χ∙frzx1x~ 2x4x* ≡ 2c

*\* \* ⅛ r a*

*× r2 d1 X* + J *rz x^ X — r4 x — d1 xz X —* 2 *x4 x.*

The attraction of the whole ſhell of redundant matter will be had by taking the fluent of this formula, which is *e* ∕ 3 r2 x3 *d2 x3* 2 *x5 ∖*

*2c~y. × ( r2 di x* -J- *— r4 X — ),*

*rd4 ∖ 3* 3 5 *J*

*e*

and then make *x = r.* This gives *2c ~--τy∙ {d2 r3* + rs — ri — *y dz r3 — y rs),* which is = 2 c *~ſ~ſi* (τ *^lr^3—τ r0> 4c e rt* 4 *r4*

= -, vT . To this add the attraction of the inſcribed ſphere, which is ⅔cr3/d2, and we have the attraction of the whole ſpheroid

*c r3 c e rz c er4 d^ + r d2 r d4*

*Cor.* I. If the particle P is ſituated preciſely in N, the pole of the ſpheroid, the attraction of the ſpheroid, is cr + 8/15*ce.*

If the ſpheroid is not oblate, but oblong, and if the greater ſemiaxis be r, and the depreſſion at the equator be *e,* the analyſis is the ſame, taking *e* negatively. Therefore the attraction for a particle in the pole, or the gravitation of a particle in the pole, is ⅔cr — 8/15*ce.*

But if the polar ſemiaxis be r + e, and the equatorial ra­dius be r, ſo that this oblong ſpheroid has the ſame axis with the former oblate one, the gravitation of a particle in the pole is 2/3*cr* + 2/15*ce.*

*Cor.* 2. If a number of parallel planes are drawn perpen­dicular to the equator of an oblong ſpheroid, whoſe longer ſemiaxis is *r + e,* and equatorial radius r, they will di­vide the spheroid into a number of ſimilar ellipses ; and ſince the ellipse through the axis has *r + e* and *r* for its two ſemiaxes, and the radius of a circle of equal area with this elipse is a mean proportional between *r* and *r + e,* and therefore very nearly = *r + ½e,* when *e* is very ſmall in comparison of r, a particle on the equator of the oblong ſpheroid will be as much attracted by theſe circles of equal areas, with their correſponding ellipſes, as by the ellipſes. Now the attraction at the pole of an oblate ſpheroid was ⅔cr + 8/15ce*.* Therefore putting ½*e* in place of *e,* the attraction on the equator of the oblong ſpheroid will be equal to ⅔*cr* + 4/15ce.

Thus we have aſcertained the gravitations of a particle ſituated in the pole, and of one ſituated in the equator, of a homogeneous oblong ſpheroid. This will enable us to ſolve the following problem :

If the particles of a homogeneous oblong fluid ſpheroid attract each other with a force inverſely as the ſquares of their diſtances, and if they are attracted by a very diſtant body by the same law, and if the ratio of the equatorial gra­vity to this external force be given ; to find what muſt be the proportion of the ſemiaxis, ſo that all may be in equili­brio, and the ſpheroid preſerve its form?

Let *r* be the equatorial radius, and *r + e* be the polar ſemiaxis. Then the gravitation at the pole *m* is ⅔cr + 2/15*ce,* and the gravitation at the equator is ⅔cr + 4/15ce. Now by the gravitation towards the diſtant body placed in the direction of the polar axis, the polar gravitation is diminiſhed, and the equatorial gravitation is increaſed ; and the increaſe of the equatorial gravitation is to the diminu­tion of the polar gravitation as NO to 2mO. Therefore if the whole attraction of the oblong ſpheroid for a particle on its equator be to the force which the diſtant body exerts there, as G to P, and if the ſpheroid is very nearly ſpherical, the abſolute weight at the equator will be ⅔*cr* + 4/15ce + ⅔cr × P/G*.* And the abſolute weight at the pole will be ⅔*cr + 2/15ce — ⅔cr* × 2P/G*.* Their difference is 2/15*ce* + 2cr × P/G.

Now if we ſuppoſe this ſpheroid to be compoſed of similar concentric ſhells, all the forces will decrease in the ſame ratio. Therefore the weight of a particle in a column reaching from the equator to the centre will be to the weight of a ſimilarly ſituated particle of a column reaching from the pole to the centre, as the weight of a particle at the equator to the weight of a particle at the pole. But the whole weights of the two columns muſt be equal, that they may balance each other at the centre. Their lengths muſt therefore be reciprocally as the weights of ſimilarly ſi­tuated particles ; that is, the polar ſemiaxis muſt be to the equatorial radius, as the weight of a particle at the equator to the weight of a particle at the pole. Therefore we muſt have 2/15ce + (2cr × P/G) : ⅔cr + 2/155ce *— (4/3cr* × PG) = e : r.

Hence we derive (*2r* × P/G) *= 8/15e,* or 4G : 15P = *r : e.* This determines the form of the fluid ſpheroid when the ra­tio of G to P is given.

It is well known that the gravitation of the moon to the earth is to the diſturbing force of the fun as 178,725 to 1 very nearly. The lunar gravitation is increaſed as ſhe approaches the earth in the reciprocal duplicate ratio of the diſtances. The diſturbing force of the sun diminishes in the ſimple ra­tio of the diſtances ; therefore the weight of a body on the ſurface of the earth is to the diſturbing force of the sun on the ſame body, in a ratio compounded of the ratio of 178,725 to I, the ratio of 3600 to 1, and the ratio of 60 to 1 ; that is, in the ratio of 38604600 to 1. If the mean radius of the earth be 20934500 feet, the difference of the axis, or the elevation of the pole of the watery ſpheroid pro­duced by. the gravitation to the sun, will be 15/4 × 20934500/38604600 feet, or very nearly 24½ inches. This is the tide produced by the sun on a homogeneous fluid ſphere.

It is plain, that if the earth conſiſts of a ſolid nucleus of the same denſity with the water, the form of the ſolar tide will be the ſame. But if the denſity of the nucleus be dif­ferent, the form of the tide will be different, and will de­pend both on the denſity and on the figure of the nucleus.

If the nucleus be of the ſame form as the ſurrounding fluid, the whole will ſtill maintain its form with the ſame. proportion of the axis. If the nucleus be ſpherical, its ac­tion on the surrounding fluid will be the ſame as if all the matter of the nucleus by which it exceeds an equal bulk of the fluid were collected at the centre. In this case, the ocean cannot maintain the same form : for the action of this central body being proportional to the ſquare of the diſtance inverſely, will augment the gravity of the equatorial fluid more than it augments that of the circumpolar fluid ; and the ocean, which was in equilibrio (by ſuppoſition), muſt now become more protuberant at the poles. It may, how­-