mate horary angle *t'* will be found from the variation, or the moon's age in space.

Now, in Burckhardt's Tables, p. 87, we find the varia­tion for the midnight ending 1823, by adding the constant quantity 9° to the epoch for 1824, and (11s. 14° 44' 44" + 9° = 11s. 23° 44' 44", or — (6° 15' 16"), according to the time of Paris. The movement for 12 hours is 6° 5' 43"; consequently at noon, or 1824 Jan. 1, 0h. astronomical time at Paris, the variation is — (9' 33"), corresponding to the movement of 18m. 49s. in mean time, and the mean con­junction will take place at 18m. 49s. Parisian time, which may be more compendiously expressed by calling it the true mean noon, in the time of the island of Guernsey or of Dorchester ; and the movement in 24 hours being 12° 11’ 26∙5" = 12·10°, we shall have *t' =* 360°— 12∙19°

= 347∙81° when *t=* 360°, or *t'* = 347·81/360*t* = ·96614*t*; and the moon’s horary angle, considered in relation to the cir­cumference as unity, will always be ∙96614*t*, if *t* be the num­ber of days elapsed from the noon of 1st January 1814 at Guernsey.

The sun’s mean longitude for the same epoch is (279° 35' 23∙1'') = ·77666; his longitude for any other time will therefore be ∙77666 + ∙002738*t* =, and that of the moon = ·77666 + ·03386*t*.

We may compute, with sufficient accuracy, the effect of the modifications produced by the change of the moon’s distance, or the inequality of her motion in her orbit, or of the periodical change of the inclination of her orbit to the equator, which takes place from the revolution of the nodes, by simply considering the changes which will be produced in the forces concerned by these inequalities, and suppos­ing the effects simply proportional to their causes. If, how­ever, it were desired to determine these modifications with still greater precision, we might deduce approximate for­mulas for expressing them from the elements employed in the Tables.

The epoch of the moon’s mean anomaly for 1824 is (4s. 29° 25' 23∙3") + 2° — 151° 25' 23·3"; the movement for 12h∙ 18m∙ 49s. is (6° 31' 57") + (9' 47∙9") + 27" = 6° 42' 12", which gives 158° 7' 35" for the mean anomaly at noon in the island of Guernsey. The daily movement be­ing 13° 3∙9' = 13∙065°, the mean anomaly will always be 158∙127° 4- 13∙065°*t*, reckoning *t* from the supposed epoch or day. The principal part of the central equation will then be, according to Burckhardt, 22692∙4" sin. *An*., or (6° 18∙2') sin. (1581/8° + 13∙665°*t*). and its sine will be very nearly ∙11 sin. (13∙065°*t* + 158·127°), which will represent the principal inequality of the longitude and of the varia­tion, so that the variation, instead of 12∙19°*t*, will become 12∙19°*t* + 6∙3° sin. (13∙065°*t* + 158∙127°), and this sub­tracted from 360°*t* leaves 347∙81°*t*—6’3° sin. (13∙065°*t* + 158∙127°), the sine of which is nearly sin. 347∙81°*t* — cos. 347∙81°*t* ∙11 sin. (13·065*t* + 158∙127°).

The equatorial parallax is nearly 57' + 187" cos. *An., or 57'* + 3∙1 cos. (13∙065°*t* + 158·127°); and the disturb­ing force, which varies as the cube of the parallax, or of 57 [1 + ·0544 cos. (13∙065°*t* + 158∙127°)], may be ex­pressed, with sufficient accuracy, by 1 + ·1632 cos. (13∙065°*t* + 168-127°).

The supplement of the node for 1824 is (2∙10∙56) + 2' = 70° 58', to which we must add (3'∙10∙6") *t* for the time elapsed ; and the longitude will be 279° 35' 23∙1'' + (13° 10' 35") *t.*

Although the value of the co-efficient *B* is not directly discoverable, we may still obtain a tolerable estimate of its magnitude in particular cases, by inquiring into the conse­quences of assigning to it several different values, equal, for example, to the co-efficient of the solar or lunar tide, or greater or less than either ; while we assume, also, for the

co-efficient of the resistance, *A,* a great and a smaller value, for instance 1/3 and 1⅛, supposing 1/10*)* to be inconsiderable. We then find, from the expression √(α2 + β2) *M =* √(α2 + *β2) Bμ,* (Theorem K, Schol. 2) = \*\*\*\*\*

√[(gG -⅜ + Λ¾^GG], f°r the β°lar tide, G being

l,ιi

*B=* ⅛, ∙D3442, 1, or 4;

4— ∫⅛! — ∙980, —7-550, 10, 1’3324,

l⅜t — ∙832, — 2∙742, 3, 1-3252;

and for the lunar, *G* being ∙96614, and

, ∫f⅛5 —1-122, 10, 8∙197, l∙3036,

j ⅜ ; — ∙913, 3, 2∙942, l∙2968,

respectively.

Hence it appears, that the resistance tends greatly to di­minish the variation in the magnitude of the tides, depen­dent on their near approach to the period of spontaneous oscillation, and the more as the resistance is the more con­siderable ; and supposing, with Laplace, that in the port of Brest, or elsewhere, the comparative magnitude of the tides is altered from the proportion of 5 to 2, which is that of the forces, to the proportion of 3 to 1, the multipliers of the solar and lunar tides being to each other as 5 to 6, we have *l . 36BΒ 25BB*

the equation ~~(1~~ ~~\_ ψ~~ ~~3~~~~, =~~ ~~whence~~

we find that *B* must be either ∙9380 or ∙6328 ; and the for­mer value making the lunar tide only inverse, we must sup­pose the latter nearer the truth; and the magnitude of the tides will become 1∙663 and 1·998. And it appears from the same equations, that, *n* remaining = ∙93442, *A* cannot be greater than \*\*\*\*\*\*632, and *B* would then be \*78540; and if *A — 0,* the values of *B* would be ∙9617 or \*6QΘ1. It seems probable, however, that the primitive tides must be in a somewhat greater ratio than this of 2 to 1 and 5 to 3, when compared with the oscillations of the spheroid of equili­brium ; and if we supposed *B* = ∙9 and *A* still = -⅛, we should have 7∙07l and 9∙756 for their magnitude. Now if *B* = ∙6328, the tangents of the angular measures of the *,. , β AG* 1 , ∙966l4

displacement, - = g, become and

respectively, giving us 69o 50' and 72° 40, for the angles themselves ; and if *B ~* ∙9, these angles become 450 and 70° 24, respectively ; the difference in the former case 2° 50', and in the latter 25° 24', which corresponds to a motion of more than twenty-four hours of the moon in her orbit.

It appears, then, that, *for this simple reason only,* if the supposed data were correct, the highest spring tides ought to be *a dag later* than the conjunction and opposition of the luminaries ; so that this consideration requires to be combined with that of tire effect of a resistance proportional to the square of the velocity, which has already been shown to afford a more general explanation of the same phcno- menon. There is indeed little doubt, that if we were provided with a sufficiently correct series of minutely ac­curate observations on the tides, made, not merely with a view to the times of low and high water, but rather to the heights at the intermediate times, we might by de­grees, with the assistance of the theory contained in this article, form almost as perfect a set of tables for the mo­tions of the ocean as we have already obtained for those of the celestial bodies, which are the more immediate objects of the attention of the practical astronomer. There is some reason to hope that a system of such observations will speedily be set on foot by a public authority ; and it will be necessary, in pursuing the calculation, on the other hand, to extend the formula for the forces to the case of a sea performing its principal oscillation in a direction ob-