XI. On addition and subtraction of Algebra

Mr. Paul Newton

The other difference of the two catalogues (viz. that the southern stars have, according to Mr. Pond, much less right ascension than with me) seems to proceed from a *constant error in the fixing of one of the two transit instruments.* This difference shows itself very clearly in the comparison above mentioned; and amounts, in the case of α *Piscis Australis,* to as much as 0″,235. It may indeed have its origin in a bend of the telescope, or in a wrong determination of the line of collimation (perhaps produced by the former), since this must occasion an erroneous reduction to the meridian. Assuming that the transit instrument describes a great circle, then an error of the collimation, $= \Delta c$, has the influence Δc tang $(45 - \frac{1}{2}\delta)$, on the reduction ; provided the correction is determined by the pole star. This error of the collimation however would be so great, that it could not escape the observer ; whence it is not improbable, that there are still other causes which have occasioned a deviation from the meridian.

The above-mentioned rigorous trial, of the meridional circle of Reichenbach, was principally directed to this point : and I believe I shall be able to prove, that the method, followed by me, cannot leave a perceptible doubt in the determination of the collimation. I have thence been enabled also in this respect to try by new observations my former data, and shall mention here what I obtained for α *Scorpii,* and α *Piscis Australis,* viz. for 1820

$$\alpha \ \textit{Scorpii} \qquad = 16^{h}.18^{m}.23^{s},249 \qquad 25 \ \text{obs.}$$
$$\alpha \ \textit{Piscis Aust.} = 22. \ 47. \ 41 \ ,197 \qquad 21 \ \text{obs.}$$

differing from my former determination $-0″,088$ and $+0″,0771$; and from that of Mr. Pond $+0″,112$ and $+0″,330$. So that, in this too, the new observations speak in favour of the Königsberg Catalogue.

In a few years I hope to be able to give a perfectly new fundamental Catalogue. I merely undertook the present preliminary investigation of some stars, in order to ascertain whether any *constant errors* have crept into my former catalogue, in spite of every precaution. I believe that I may apprehend this less now than before.

XI. *On Addition and Subtraction of Algebra.* *By Mr.* PAUL NEWTON.

To Dr. Tilloch.

SIR, — ALL those authors who have treated on Addition of Algebra, at least all those authors (a numerous class) to whose works

Works I have had access, make no essential difference between some parts of Addition and some parts of Subtraction of Algebra. From an attentive consideration of the subject, I feel persuaded that the operations of Addition should be restricted to quantities, whether like or unlike, which have like signs. That part of Addition which is employed in collecting quantities, whether like or unlike, which have unlike signs, should be classed under the rule for the Subtraction of *simple quantities.* Our authors define clearly enough that the sign + denotes Addition, and that the sign — denotes Subtraction; they then blend these signs, or blend the quantities to which these signs are prefixed, and sometimes call the mixture Addition, and sometimes call it Subtraction. Dissatisfied with this procedure, Mr. Bonnycastle recommends *new names* for these two primary rules; as if there were some secret charm in a name absurdly applied. If any objection lie against the term Subtraction, as Mr. Bonnycastle supposes and affirms, that objection may be obviated by removing the cause, whether real or imaginary. "The incongruous mixture," as Mr. Bonnycasle styles it, may be removed or avoided, if offensive, by transposing the negative term or terms from the minuend to the subtrahend, and by transposing, also, the negative term or terms from the subtrahend to the minuend; by which means, we shall have nothing but positive terms in the minuend, and nothing but negative terms in the subtrahend. Thus, retaining the old form of writing the quantities, if from

$$4x + a - b$$

we take $4x + b - 3a$,

we shall obtain, by transposing the negative terms, this arrangement, viz.

$$4x + a + 3a$$
$$-(4x + b + b)$$

or this, viz. $4x + 4a - 4x - 2b = 4a - 2b = $ diff. required.

For, the difference between any two quantities will remain the same, whether we equally augment or equally diminish them. Thus, let a exceed b; and, to avoid ambiguity, let a, as well as b, exceed c; then will $a - b = (a+c) - (b+c) = (a-c) - (b-c)$. Therefore, if from $4x + a - b$

we take $4x + b - 3a$,

first, augment both quantities by b, and we obtain this arrangement, viz. From $4x + a$

Take $4x + 2b - 3a$.

Now augment both quantities by $3a$, and we shall have this arrangement, viz. From $4x + 4a$

Take $4x + 2b$,

or this, viz. $4x + 4a - (4x + 2b) = 4a - 2b = $ diff. as before.

Both quantities, in a manner analogous to the method employed

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ployed in common arithmetic, have been equally augmented, and the augment of each quantity, in this case, is $= 3a + b$; but the difference between these augmented quantities is, as I have shown, the same as it would have been between the original proposed quantities.   I am sir, very respectfully,

Your obedient humble servant,

PAUL NEWTON.

XII. *A Question addressed to the Rev.* J. GROOBY, *respecting the Tables employed by him in calculating the Corrections of Dr.* MASKELYNE's 36 *Stars. By* A CORRESPONDENT.

To Dr. Tilloch.

SIR,—WILL you permit me, through your Journal, to ask your correspondent Mr. Grooby, *what* tables of Professor Bessel's he makes use of in the calculation of the Corrections of Maskelyne's Stars. I have not heard of any except those annexed to his Observations, and 1 do not find that they give the same corrections as Mr. G. uses, though very near to it.   It is a circumstance not generally known, perhaps, to your astronomical readers, that the Professor himself does not use his *own* tables in reducing his observations ; as any one may satisfy himself, if he will only take the trouble of reducing a few of the transits he has published, and comparing the results with the corrected Right Ascension given by the Professor himself.   I have calculated some hundreds, and never found one agree : hence I had supposed that I must have mistaken his *mode* of calculation, particularly as he has given no example of his method of using his tables.   But in his *Astronomiæ Fundamenta* he *has* given examples, and, what is most extraordinary, not one of the corrections in those examples agrees with the one given by the table.   Give me leave to notice one more particularly,—and I will take the first.   Where the correction of α *Lyræ* is required on the 13th of December 1756. Adding, as the two preliminary tables direct, 1.56, I am to look out in Table 1st for the correction answering to December 14. 56. Now opposite to December 6. I find +0.273, and opposite to December 16. +0.246, difference ,027.   I say therefore,—As 10 days is to ,027, so is 8.56 to ,023 ; which, as the numbers are diminishing, is to be subtracted from +0.273, and give +0.250 for the correction ; but in the example it is +0.247. This, it is true, is no great difference ; but small as it is, it ought not to be, and Mr. Grooby will perhaps find some difficulty in accounting for it, as well as in maintaining his opinion, that *M. Bessel's Tables are the most correct yet published.*

I am sir, your obedient servant,

OBSERVER.