circumstances mentioned in a letter written by him to Dr. *Wollaston*. The instrument with which I first observed it in 1810 close double, was a Reflector of the worst possible construction viz. a Gregorian Reflector of 6 inches aperture and thirty inches focal length, but a very perfect instrument made for me by Mr. *Watson*

in the year 1809, and which is now in the possession of my friend Mr. *Frederick Perkins*.

I am happy to say that I have observed *Encke's* Comet, — and also the Comet of the constellation *Taurus* four successive nights viz. August 21, 22, 23 and 24.

Schreiben des Herrn J. F. W. *Herschel* F. R. S. an den Herausgeber.

Slough 1825. Aug. 15.

Dear Sir.

In the 74th Number of your *Astronomische Nachrichten*, you have obliged the Astronomical world with Mr. *Fraunhofer's* account of the superb Equatorial, constructed by him for the observatory at Dorpat. The existence of such an instrument in such hands ought to be a matter of congratulation to every lover of science and I am rejoiced to hear from M. *Fraunhofer* that, so far from resting satisfied with what he has already achieved, he has extended his views to the construction of still more powerful instruments and is actually employed on an equatorial of 12 inches aperture and 18 feet focal length, which will indeed deserve to be regarded as a chef-d'œuvre of art.

I have not the least disposition to doubt the merits of the Dorpat Telescope, which I have not seen, but which I am disposed to believe one of the best, probably the very best refracting telescope, ever made. The accounts which Mr. *Struve* has been so kind as to transmit me of its extraordinary power, are quite satisfactory. A telescope capable of easily separating the stars of α Leonis and giving exact and coincident measures of their relative position on several nights, can admit of no question as to its excellence. I have hitherto heard but of one other refracting telescope in which this star has been seen double. It is that by *Lerebours* now at the Royal Observatory at Paris, the object glass of which (Like the Dorpat telescope) is 9 inches in aperture, though only $8\frac{1}{2}$ are effectively employed. Mr. *Struve* however has discovered double stars still closer than α Leonis with his magnificent instrument.

My immediate object in writing this however, is to obviate an erroneous impression which may arise in the minds of those who read M. *Fraunhofer's* memoir, as to the great inferiority of reflecting telescopes in point of optical power, to achromatics in general, and more

especially to those constructed with such delicacy as his own doubtless are. Those who have witnessed the performance of M. *Amici's* beautiful Newtonian reflectors, will not readily admit this inferiority, but will rather feel disposed to wish that some attempt might be made to accommodate such admirable instruments to the more exact purposes of Astronomy, an object which appears to have been too easily lost sight of.

M. *Fraunhofer's* expressions when speaking of the loss of light by metallic reflexion are, I think, somewhat too strong. He observes that „the most perfect metallic „mirror reflects only a small part of the incident light, „and that the greater part is absorbed“ and that, „in „consequence, the intensity of the light entering the eye „of the observer is always very small“ (ist immer sehr gering). A metallic mirror however reflects 0.673 of the incident light, or more than two thirds, and absorbs less than one third of the whole. M. *Fraunhofer* appears rather to have had in view the Newtonian construction where two metallic mirrors are used and where the whole effective quantity of light is only 0.452 of the incident rays. No one who has been half blinded by the entrance of Sirius or Lyra into one of my Father's 20-foot Reflectors, will say that the intensity of its light is small, nor, to take a less extreme case, will any one who uses one of M. *Amici's* Newtonian reflectors of 12 inches aperture (a perfectly convenient and manageable size, and of which he has constructed several) be disposed to complain of its want of light. The ordinary reflector used by my Father in his reviews of the Heavens was a Newtonian of 7 feet focus and barely 6 inches in aperture, and consequently equal (caeteris paribus) to an achromatic of $4\frac{1}{4}$ (4.254) English or 3.99 Paris inches and therefore by no means proper to be put in competition with M. *Fraunhofer's* chef-d'œuvres of 7 and 9 inches. Yet it will be recollected that with this telescope and with a magnifying power of 460, α Leonis

was discovered to be double and distinctly separated, and its angle of position measured.

In order to demonstrate the superiority of refracting over reflecting telescopes, M. *Fraunhofer* has selected the star ζ Bootis, which my Father has described as a double star of the 6th class (N° 104) in his second catalogue of double stars, but without mentioning the division of the large star into two, as a double star of the first class. It might however be very easily overlooked in a review in indifferent weather. It is at least as difficult to resolve as η Coronæ, more so than σ , either of which, with any telescope, be its goodness what it may, requires a favorable atmosphere for its separation. From this omission however M. *Fraunhofer* concludes that the power of the telescope was insufficient to resolve it, and must therefore have been inferior to that of an Achromatic in the hands of M. *Bessel*, with which it was recognized by that eminent Astronomer as double. It will be seen on reference to the Memoir on double stars lately published in the Philosophical Transactions by Mr. *South* and myself that this star had been long since ascertained to be double not only by Mr. *Bessel*, but by Messrs. *Struve*, *Pond*, and *South*, and, what is more to the present purpose, by Sir *Wm. Herschel* himself. It was only by oversight that we omitted to refer in that work to his account of it, which is published in his paper „on the places of 145 new double stars“ in the 1st Vol. of the Transactions of the Astronomical Society, page 178. Which paper was read on June 8. 1821. It will not be amiss if we extract the account verbatim.

„(114). Journal. April 5. 1796 — 7 feet reflector ; power 460 (ζ) Bootis double 1st Class. Very nearly „in contact; I can however see a small division. A little „unequal, the preceding is the smallest.“

„Rev. Aug. 6. 1796. ζ Bootis double. Position „2 Rev. — 14,5 parts + 1,1 for Zero = $41^{\circ} 59' 1''$ np. „With 460 a division is but barely visible $\frac{1}{3}$ of S. Both w. „A little or pretty unequal.“

„Rev. July 12. 1807. ζ Bootis. They are fine, „equal, whitish stars: the interval between their apparent „discs with 460 is $\frac{1}{3}$ of the diameter of either.“

To these observations I will only add that with the same telescope, but with a mirror much tarnished and now used only for the most ordinary observations I last night saw this star, as well as σ Coronæ and η Coronæ, distinctly double.

The argument then from the omission of this star is untenable. ζ Orionis would have furnished a case much more in point. The very singular history of this star will be found in the memoir on double stars already mentioned.

In large reflectors in which only one metallic mirror is used the disadvantage in point of light under which they labour in comparison with refractors is however much less formidable. A reflector of 18 inches aperture would be equivalent to an achromatic of $15\frac{1}{2}$, and one of 48 inches to an achromatic of $41\frac{1}{2}$ in aperture, a size we can not suppose (from any thing we have yet seen) that it is possible the latter should ever attain. Reflectors of 18 or 20 inches are perfectly manageable, and, I apprehend quite within the power of any good artist to execute, and (if intended only for use, and not at all for show) at no very ruinous expence. That which I habitually use, of the former dimension is my own workmanship (en amateur) and though inferior in distinctness to the exquisite one used by my Father in his sweeps, is by no means an instrument to be despised. Indeed from the experience I have had of these telescopes, I am satisfied of their applicability even to the more exact purposes of Astronomy and that great improvements in their construction and mechanism remain to be made.

Having referred to the paper on double stars published by Mr. *South* and myself, permit me (with his concurrence) to rectify some errors into which we have there fallen, and which have been recognized by him in the course of his observations at Passy in continuation of the same subject, the results of which I hope will, ere long, be before the public, and will afford a convincing proof of his zeal and indefatigable industry. — The first of these errors is in the case of the small star accompanying 36 Ophiuchi. It is stated in the work referred to (as the result of a single measure, probably a hasty one, or affected by an accidental derangement of the micrometer head) as having its position $19^{\circ} 5' np$ and distance $3' 0'' 735$. There is no memorandum of which of the close stars the position was measured from, but it must have been from the most southern, as Mr. *South* by a mean of 10 measures finds $17^{\circ} 41' np$ for its angle of position with respect to this star. The difference ($1^{\circ} 24'$) is not very important, but the distance is greatly in error. Mr. *S.* has determined the distance of the small star from the more southern of the close stars (by a mean of 19 measures) at $3' 15'' 252$ and from the more northern (by a mean of 21) at $3' 13'' 689$.

The next correction I have to notice is in the case of π Aquilæ whose position and distance are stated at $45^{\circ} 27'$ sf and $1'',957$ respectively, while Mr. *South's* recent measures, which appear entitled to preference, being the results of 19 measures of angle and 10 of distance taken on 4 different nights, and agreeing well together, make the mean result as follows.

Position $33^{\circ} 14'$ sf; Distance $1'',447$; Epoch 1825.59. It seems certain therefore that an error of 10° must have been committed in the reading off of the printed angles. Granting this, the remaining error of $2^{\circ} 13'$ would be pardonable in so very close a star as the result of a single set of measures.

In the remarks I have thought it necessary to make on that part of Mr. *Fraunhofer's* memoir which refers to the action of reflecting telescopes, I should be very sorry to have expressed myself in any way capable of being construed in a controversial sense, or as intended to give

the slightest personal offense to its celebrated author, who, as an artist must surely be ever regarded as a benefactor to Astronomy, while optical science is no less indebted to him as a philosopher, for his beautifully delicate experiments on the constitution of the Prismatic spectrum, which have given a degree of precision to optical determinations hitherto unheard of, and shewn the practicability of placing the construction of telescopes on purely scientific grounds, while they have unfolded phenomena of the highest interest in a speculative point of view. Nor can I help feeling that I should ill requite his liberal and friendly reception during a visit to Munich which I shall ever recollect with pleasure, and in which I had ample opportunity to admire both the resources of his genius and the simplicity of his manners, by a word calculated to give pain or excite unpleasant feelings,

„quod vitium procul abfore chartis
Atque animo prius, ut si quid promittere de me
„Possum aliud, vere promitto.“

J. F. W. Herschel.

Schreiben des Herrn Professors *Argelander*, Directors der Sternwarte in Åbo, an den Herausgeber.
Åbo 1825. Aug. 20.

Ich kann Ihnen heute meine beiden ersten Beobachtungen des *Ponsschen* Cometen schicken. Das beständig trübe Wetter verhinderte die Aufsuchung bis zum 17^{ten} August. Diesen Abend aber fand ich ihn noch nahe am Horizont; obgleich keinesweges hell, ist er doch recht augenfällig und gut zu beobachten. Aus Mangel an bestimmten Sternen mußte ich unbestimmte zur Vergleichung wählen, deren ungefähre Po-

sition ich durch einmalige Vergleichung mit τ und σ II bestimmte zu

a $110^{\circ} 20' 16,7''$ + $30^{\circ} 19' 56,9''$
b $109 54 41,2$ + $30 11 51,2$
c $111 36 11,0$ + $29 34 21,1$

Mit diesen Positionen geben meine Beobachtungen folgendes Resultat:

Aug. 17.	$12^h 55' 12''$ MZ. Åbo.	$110^{\circ} 9' 12,7''$	—	5 Beob. a.	— $2' 6,0''$
	57 28,5 - -	—	+ 30 16 58,4	4 - b.	 + $0' 44'',3$
	58 59 - -	31,4	—	6 - b	— $2' 6,4''$
— 18.	$12 53 8$ - -	$112 5 57,4$	+ 29 54 44,2	5 - c	— $2 10,6 + 1' 33'',3$

Die hintergesetzten Fehler der Ephemeride zeigen, wie herrlich diese stimmt. Wahrscheinlich wird der Comet in Deutschland schon weit früher gefunden worden seyn, vielleicht läßt aber meine nördliche Lage zu, ihn länger zu verfolgen, da er am letzten August hier noch eine Stunde früher aufgeht, als in Seeberg, während der Unterschied der Dämmerung dann doch nicht mehr bedeutend ist.

Ich weiß nicht, ob ich Ihnen früher schon von den Thermometern aus der hiesigen Werkstatt des Herrn

Professors *Bäcker* geschrieben habe; es würde gewiß vielen Leuten dadurch ein Dienst geschehen, wenn diese Thermometer allgemeiner bekannt würden. Sie verbinden bei geringem Preise Richtigkeit in den Normalpunkten und in der Theilung. Die Normalpunkte werden mit der größten Sorgfalt bestimmt, wie ich mich davon durch den Augenschein und durch eigene Untersuchung überzeugt habe. Was die Theilung betrifft, so setze ich hier die Correctionen einiger nach *Bessels* Methode geprüften Thermometer her: