

V. *A Letter from Mr Stephen Gray, concerning drawing the Meridian Line by the Pole Star, and finding the hour by the same.*

Canterbury, May 5. 1701.

Sir,

I Have sent some farther thoughts upon the Instrument for Drawing a Meridian line, which you had an account of in my last, and have improved it so far, as that at the first mentioning it may perhaps seem a Paradox even to Astronomers, when they shall hear that no other Star will be made use of than the Polar one to obtain the hour and minute of the day or night; but it will soon cease to be so when I have described the Instrument.

Let there be taken a Telescope of about 16 foot, or longer if you please, in the Plane of its focus place a Ring of Brass at right angles to the axis of the Glass, the Diameter of the inward Circle equal to the double Tangent of the Pole-Star from the Pole, the focal length of the Object Glass being made Radius, as was said in the Description of the Meridian Instrument; let the Ring be divided into 24 hours, with their minutes number'd from the right hand towards the left, as in our common Nocturnals; the Eye Glass must be equal in its diameter to the Horary Ring: but this perhaps will be thought too chargeable, especially for such large Telescopes as I am speaking of, which has made me think of this contrivance; the Eye Glass must lye in a broad Index towards one end, this is to turn on a Center Pin, that lies in the Center of the Glass, and consequently over the Center of the Horary Ring, from which

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it must be equal to the distance of the focus of the Eye Glass, then let the Tube be elevated to the height of the Pole, and directed to the Pole Star, till by turning the Index through the Eye Glass, you perceive the Star to touch the Horary Ring on that side the Star in the Great Bears Rump lyes, or on the opposite to that in the Hip of *Cassiopeia*; but the contrary, had not the Glass inverted the Object, then bring one of the 12s to be in a perpendicular to the other by a Plum line, so will the Star stand at its Horary distance from the Meridian; or if the Latitude of the Place be unknown by the Right Ascension of the Sun and Star, the line of its coming to the Meridian will be easily obtained, and then the Hour of the night found, will as easily give the Stars horary distance from the Meridian; then elevate the Tube towards the Star; bringing the Meridian, or 12 and 12 into the plain of the perpendicular, turn the Glass about till you see the Pole Star stand at its Horary distance from the Meridian; so will the Instrument when fixed, shew the Horary distance throughout the whole day, or as long as it remains in this position, by the apparent motion of the Star in the Ring. The best time to fix the Instrument, will be when this, or any of the other two Stars above-mentioned, are about 6 hours from the Meridian. You may be pleased, Sir, to take notice, that the Latitude of the place is now given with the utmost Preciseness, for the axis of the Glass lies now in the axis of the World, and if one of the sides of the Tube be parallel thereto, as it ought to be at the upper end, hang a Line and Plumet from the point of the suspension; find another point equal in distance to the length of the Line, or a knot towards the lower end, the distance from this knot to the former point will be but the Chord of the latitude, and if from the same edge of the Index, another Line and Plumet be hung towards the lower end of the Tube, these two lines, when at rest, will be in the plain of the Meridian.

This.

This Instrument may be made to shew the hour with as much facility, as a Clock or Sun-dial, if the Horary Ring be made to move within a larger fixed one, and the outward Circle of the former be divided into the days of the month, respect being had to the Right Ascension of the Sun and Star; then by bringing the 2 opposite points in the fixed Circle to the Perpendicular, which is done at the fixing the Instrument, move the Circle till the day of the month come to any of these, and the Ring is rectified for that day, and if the air be clear, you will see the Star stand at the true time of the day or night.

It may be objected, that in few years by the Annual increase of its declination, the Pole-Star will by moving in a lesser Circle be brought too far from the edge of the Ring, that the exact hour and minute cannot well be distinguish'd; but this inconveniency, when it is one, may be easily remedied several ways, either by making a lesser Ring, or by extending a fine thread of Silk cross the Ring, till it cuts the Star, and at the same time it gives the hour, or, which will yet make this Instrument commodious for other purposes, there may be made an Index to move on the Center of the Hour-wheel, which being brought to cut the Star with the edge that proceeds from the Center, it will at the same time cut the hour; and now we need not be solicitous about the exact Diameter of the Ring, provided it do but a little exceed the distance of the Pole-Star from the Pole, the focal length of the Glass being made Radius.

That most Learned Accurate, and Judicious Astronomer Mr *John Flamsteed*, Mat. Reg. and F. R. S. has lately discovered, that there is a Parallax of the Earths Annual orbit at the Pole-Star of about 40 or 45 Seconds, whereby the Diameter of the Stars Parallel is greater in *June* than in *December* by about 1 Min. 2 Seconds, which he has evinced from 7 years successive observations, where-

by the Earths Motion is indubitably demonstrated, as appears from his Learned Letter to Dr *Wallis* on that subject.

Now if on the edge of this Index there be drawn a Scale of Degrees Minutes and Seconds, to the Radius of the Glass, we shall not only have a very accurate Instrument for the hour, but be furnished with one whereby we shall see the truth of the Earths motion, confirmed by the access and recess of our Star, towards and from the Pole, according to the Earths place in the Ecliptick, as that Learned person above-mentioned has discovered; and that not only when the Star Transits the Meridian, but in clear air at any time of the day; one shall likewise observe that Annual increase of the Pole Stars declination, caused by the Precession of the Equinox.

My own observations assure me, that the Pole-Star may be seen in the day time with a Telescope of 16 foot, for with one of this length I saw that Star on the 26th of *April*, this present year 1701. from 4 a Clock in the morning till 7, and cou'd have seen it longer, had not Clouds interposed; and again the 1st of *May*. I did not look for the Star till the Sun had been up more than half an hour, *viz.* at 5 in the morning, yet I soon found it, and saw it afterwards as oft as I pleased, till half an hour after 9 the same Morning, so that I doubt not this Star may be seen in a clear day, throughout the whole year.

The Declination of the Pole-Star for the year 1700, is 87 42 51, as I find it by *Ricciolus* his Catalogue of fixed Stars in the Appendix to Sir *Edward Sherbourn* his Sphear of *Mamilius*, &c. Hence its distance from the Pole at this time may be assumed 2 17. the focal length of my object Glass is 15 foot 6 inches, so that the Diameter of the Ring will be 14 inches, and 84 hundred parts of an inch, which is the natural tangent of the former arch 2. 17. doubled, a circle large enough to be di-

divided into Minutes and halves, which will be so magnified by the Eye Glafs, that it will be eafy to diftinguifh the time to a few feconds.

I muft confeſs there is ſome difficulty in fixing up this Inſtrument, and when it is ſo, to keep it from varying from its true poſition, yet 'tis not inſuperable; but for ſmall inſtruments of about 2 or 3 foot long, there cannot be, I think, a more accurate, facile, and expeditious way than this for the drawing a Meridian Line. Now whether the many benefits that may accrue to Aſtronomy, do not make the larger one worthy of the charge and trouble that there may be in compleating it, I ſhall leave, Sir, to yours and the reſt of the Illuſtrious Society's conſideration; to whoſe ſervice I am moſt humbly devoted.

*Stephen Gray.*

*VI. A Letter from Dr Martin Liſter, F. R. S.  
to Dr Tancred Robinſon, F. R. S. concerning  
pouder'd Blues paſſing the lacteal Veins, &c.  
Leatherhead, May 2. 1701.*

**W**Hen I was the other day in Town, I was ſhewn by you a moſt ingenious little Tract of Fevers: which I read over with delight. I confeſs, for want of Mathematicks, I could not well enter into ſome of his reaſonings. However, in the main, as far as I could be judge, he is much in the right, that moſt, if not all Fevers proceed from the obſtruction of the Glands.

But the occaſion of my writing this Letter to you, is the paragraph I met with page 54 of that Book: in which an experiment of mine (very many years ago publiſh<sub>t</sub>,