

errors would not be equal to their difference of latitude, as it should be. On April 17, 1866, this was tested directly, in the following way: The error both of level and collimation of each collimator was reduced as much as possible. The telescope was set vertically, the cube opened, and collimator A turned till its double wires were horizontal. The shutters were closed, as usual, in observing the collimators. Three observers were employed; one to read the level of each collimator, and one to make the images of the horizontal wires coincide. The latter looking into collimator B, set the wires opposite in each of the four combinations of position of the collimators, A 90°, B 180°; A 90°, B 0°; A 270°, B 0°; B 180°, and in each combination a set of level readings of each collimator was taken. To eliminate any possible personal error in setting, the observer then went to collimator A, and the operation was repeated. The result was as follows:

Mean level of A, (North,)	0".87, (S. end high.)
" " B, (South.)	0.29, " "
Difference - - -	+0".58 S.
Corr. for diff. of collars,	+0.26
Corr. for diff. of latitude,	+0.25
Sum - - - - -	1".09

This sum ought to be zero, so that there is a seeming discrepancy of 1".09. That this is due to refraction, I entertain no doubt, for the following reasons: (1.) *A priori*; an increase of temperature amounting to 1° Fahrenheit in two feet, will entirely account for it; and the actual increase from the floor to the roof is found to exceed this on a sunny day. (2.) A few days afterward the observations were partly repeated with the shutters open, and a cold wind blowing through the room. The discrepancy was 0".61 in the opposite direction. The images were quite unsteady, and the wind troublesome.

(65) The flexure by the opposing collimators was determined by setting the telescope on one collimator, and reading the telescope and microscope micrometers. The telescope was then pointed upward, and the horizontal wires of the other collimator set on those of the first. The circle reading was then determined for the other collimator, and the telescope again pointed to the zenith. The first collimator was then set independently on the second, and the two collimators were thus alternately set and read as often as was deemed advisable. The following are the separate results obtained on different dates:

1865. Dec. 16,	$f = +0".15$;	
1866. Mar. 29,	+0.83,	$f' = 0".77$;
April 16,	+1.42,	1.30;
26,	+0.71, wt. = 1;	
May 31,	+0.89, wt. = 2;	
June 9,	+0.49, wt. = 1.	

After the first determination the screws of the object end of the telescope tube were tightened. The two next were made without suspecting that the results might be vitiated by refraction, and therefore without attention to the equality of temperature in the different strata of air. They are therefore rejected. The last three were made with the shutters open, at times when the internal and external temperatures were nearly equal. That of May 31 was particularly satisfactory, and depends on four readings of one collimator, and three of the other, the separate readings being

N.	S.
49".39	50".77
47.81	50.87
48.12	50.09
47.87	