GENERAL RULES OF PROCEDURE

for the photographic use of the U. of I. 12" refractor

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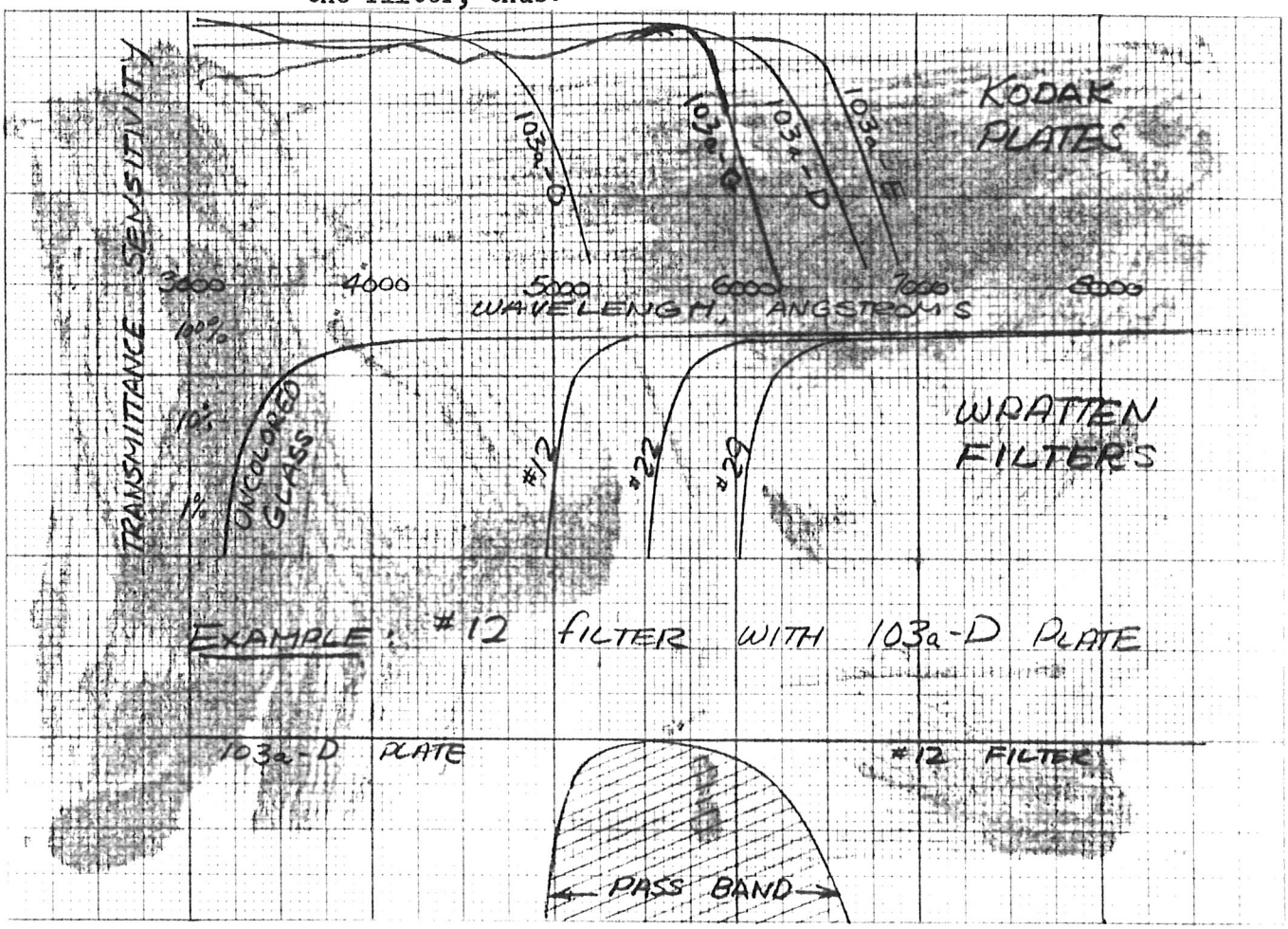
I. Plates and Filters

(a) General and specific information is available in the Kodak Data Books "Kodak Photographic Plates for Scientific and Technical Use" and "Kodak Wratten Filters for Scientific and Technical Use."

(b) In general, the combination of a filter with a plate will give an effective range of frequencies, limited at the long wavelength end by the emulsion and at the short end by the filter, thus:



Hence no filter should be used with blue-sensitive 103a-O plates which will give a range of approximately 3300Å to 5000Å. Use any desired filter with the green-sensitive E plate, depending on the desired width of pass band. (Exposure time for a narrow band must necessarily be longer than for a wide band. Chromatic aberration should be reduced to a minimum for a narrow band, e.g. as with the use of 103a-D and a No. 22 filter.)

II. The Plate Holder

(a) The plate holder is attached to the telescope by first aligning the guide eyepiece drawtube next to the small pin which holds eyepiece adaptors in place, and then turning clockwise 7 complete turns until it is firmly seated. (It is well to remember the 7 turns when removing the plateholder.) One counterweight should be removed from the eye end of the telescope. The clip leads from the guide eyepiece are then attached to the leads at the eyepiece of the finder. (Illumination can now be controlled by means of the rheostat attached to the finder scope's mounting members. Keep it as low as can be tolerated, to prevent fogging of the plate.)

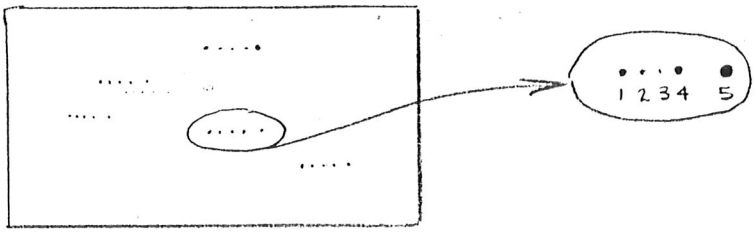
(b) Obtaining a focus plate.

1. Load a plateholder in complete darkness; use the "taste test" or any other favored method for finding the emulsion side of the plate or film.
2. Find a field containing a reasonable number of stars, with a range of perhaps 4th to 9th magnitude. (e.g. the Pleiades or other galactic clusters)
3. Focus visually on a ground glass.
4. "Doax" a bright star into the guide eyepiece (a 1 1/2 inch positive eyepiece, hand held, is useful) and center it on crosshairs by means of the slow motion drive motors.
5. Insert plate holder into its ways, pushing it in tight. Be certain it is against its brass plate as it is inserted.
6. Time your exposures with a watch or chronometer. Rack the eyepiece end of telescope to a setting numerically lower than the visual focus setting. Take 5 or 6 exposures of equal length (about 10 seconds) (more than this if you're not certain the true focus is in the neighborhood of your original setting), changing the focus setting to a higher number and moving the plate by means of a half-turn of one of the lateral screws after each exposure. Before the last exposure, turn the lateral screw one full turn. Record all data. Develop immediately.

EXAMPLE

Exposure....	1	2	3	4	5	20-second
Setting.....	3.0	3.1	3.2	3.4	3.5	exposures
Screw turns.		1/2	1/2	1/2	1	

Result:



Obviously, in this example the third exposure was the best; therefore one chooses 3.2 as the best fodus setting for that plate and filter combination at that temperature.

7. Make a focus plate on each night of photography; record the data as in the example and give the temperature. Eventually we will have enough data to plot temperature-focus curves for all filter-plate combinations.

8. Number all plates consecutively, writing on a corner with a pencil before developing.

(c) Guiding.

Try out the controls before beginning the exposure and familiarize yourself with the direction of the star will move with each button pushed. Align the crosshairs with the motion of the star.

(d) Handling of Filters.

1. Filters are to be handled with extreme care. They cost from 9 to 12 dollars each, so if you want to continue using them be careful.

2. Handle filters by their edges only. They can be lightly dusted off with a camel's hair brush. Further cleaning is described on the paper in the filter containers.

3. The 3" square filters are installed as follows:

(i) Turn the longer of the two lateral screws counter-clockwise until the plate receiber is disengaged. Pull the plate receiver (i.e., the uppermost piece of heavy brass) out and set aside.

(ii) Push the two filter retaining bars back out of the way.

(iii) Insert one edge of the filter carefully under the retaining lip opposite the retaining bars.

(iv) With the fingers at the corners of the filter next to the retaining bars, and using lens tissue to prevent direct contact with the fingers, press the filter into place. DO NOT FORCE IT!! If it does not fit, remove and turn it around. Be certain nothing is in the groove preventing its going into plade. Repeat the above procedure.

(v) Push retaining bars over corners of the filter.

(vi) Re-insert the plate receiver. Turn lateral screw clockwise to engage it. If all has been done correctly, there will be no contact between the filter and the plate receiver.

(e) The Comet Drive.

A technique which has not bye been fully developed for lackm of good comets is the use of the lateral screws and the position angle indicator for following objects with rapid motion while guiding on a "fixed" star. Comets and asteroids fall in this class of objects.

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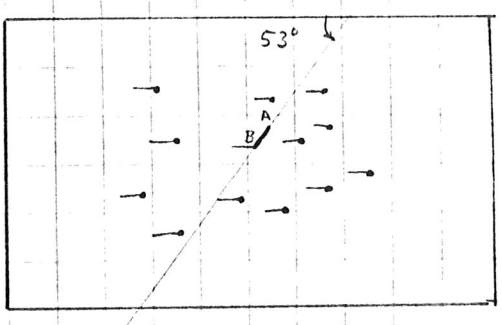
(e) The "Comet Drive."

A technique which has not yet been fully developed, for lack of good comets (previous, of course, to Arend-Roland (1956h)), is the use of the lateral screws and the position angle indicator for following objects with rapid motion while guiding on a "fixed" star. Comets and asteroids fall in this class of objects.

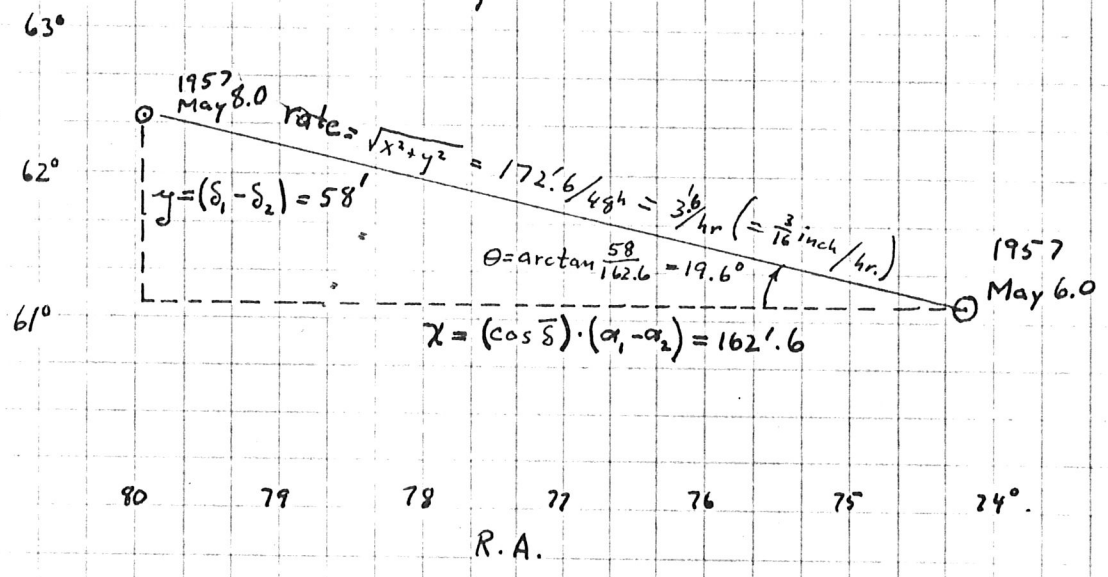
There are two methods of finding the rate and direction of motion of these objects, in order to set the p.a. indicator and to determine the rate and direction in which to turn the screws:

(1) Photograph the object while guiding on a star; develop the plate, measure the <u>length</u> of the trail of the object and its <u>angular direction</u> (measured from the long edge of the plate). The <u>direction</u> of the motion can be determined, if, at the end of the exposure, the telescope drive is turned off and the exposure allowed to continue for 30 seconds or so. This adds a trail to each image, and shows that, in the sample drawing, the object moved from A to B, a distance of $\frac{2}{16}$ of an inch, in the time of the exposure (say, 30 minutes) at an angle of 53° from the direction of orientation of the plateholder.



To make use of this information, the two clamping screws on the position angle scale of the plateholder are loosened and the rear circular section is rotated 53°, in the <u>correct direction</u> to align the motion of object in the direction of the edge of the plate, and ∴ in the direction of motion of the slide when the long screw is turned. All that is needed now is to turn the screw in the correct sense, at the rate of 2 turns in 30 minutes. (<u>The screw is cut to 16 threads per inch.</u>) It is best to divide this into as many small fractions of a turn as practical, thus making an adjustment at frequent intervals.

(2) The second method is useful when the object is very dim, or when it is impractical to develop the first plate immediately, and requires a knowledge of the ephemeris of the object. If the motion is sufficiently linear, the known position at one time before and at one time after the time of the exposure is sufficient. Thus, as an example, using Comet 1956 h (Arend-Roland), plot these two positions (mentally or on paper), converting R.A. in hours + minutes to degrees + minutes.



The angle θ is the direction of motion, measured, in this case, north of east. (Here, "east" is approximately "west"; you are looking at an object nearly <u>below</u> the pole star, so that the direction of increasing R.A. is in a circle, clockwise around Polaris.) If the p.a. indicator is calibrated, as e.g. from a previous plate exposed with the drive motor off, then the circle is turned 19.6° from the "initial line" (i.e. line running in direction of motion of the stars) (equivalent to position angle of 270 + 19.6 = 289.6°)

The rate of turning the screw is determined by applying the method shown, in which α_1 = R.A. of one position, α_2 = R.A. of the other; δ_1, δ_2 = declination at the two positions. $\bar{\delta}$ = mean of the two declinations. (Do <u>not</u> neglect the cos $\bar{\delta}$ term; this is due to convergence of the meridians at the pole, and affects both the rate and p.a. of the result.)

Having determined the "rate" in '/hr (min. of arc per hour), ~~multiply this~~ convert this to radians (sine of the angle is just as good) by multiplying by $\frac{60}{206265}$, or by looking it up, and then multiply by 2880. (= 180" x 16) to convert this to 16ths of an inch per hour. The result is then the total number of turns of the screw per hour.

The total calculation, to convert from 2'/48" to ~~#~~ turns per hour, is

~~"rate" = $\sqrt{x^2 + \cdots}$~~

$$\text{"rate"} = \left\{ \sqrt{(\delta_1 - \delta_2)^2 + \left[\cos\left(\frac{\delta_1 + \delta_2}{2}\right) \cdot (\alpha_1 - \alpha_2) \right]^2} \right\} \times (\text{~~0.8375~~})(0.0175) \text{ turns per hour.}$$