Eastman, Jack, Jr., "A Planetary Camera for a 12½-Inch Telescope", Strolling Astronomer, Vol. 15, Nos. 9-10.
Description of camera for telescope.

Eastman, Jack, Jr., "Astronomical Photography in your Back Yard", Griffith Observer, Feb., 1961.

Eastman Kodak Co. Data Guides:
Kodak Films
Materials for Spectrum Analysis*
Processing and Chemicals and Formulas*
Kodak Wratten Filters*

* Especially valuable.

COMET BURNHAM 1959k: FINAL REPORT, PART IV. SUPPLEMENTARY NOTES

By: David D. Meisel, Comets Recorder

In Part III in the May-June, 1962 Strolling Astronomer, the most general aspects of the postperihelion period of this comet were outlined. However, certain details were deleted which will be included in future papers. Other miscellaneous data do not fit into the continuity of any of the planned papers, but have definite interest and should be published. It is this material with which Part IV is concerned.

A. Colorimetric Observations

During the period of observation some colorimetric work was done. Alan McClure attempted to obtain nearly simultaneous photographs, one on a red sensitive emulsion, the other on blue. The venture was very successful. From two plates of the series it was possible to confirm the existence of short term variations in the size and shape of the comative appearance in red light. Also, differences in internal structure and tail structure were noted. The blue tail images always had a definite ray structure, while the red images showed little of such structure. On photographs taken on Apr. 22, 1960 this difference is especially evident. (Figures 5 and 6). On the blue plate the ray structure is very strong. On the red plate only the two main tail streamers are at all plain. The measured diameter of the image from the red plates was more variable than could be expected from differences in exposure and sky condition.

Gary Wegner attempted to make colorimetric intensity measurements over the entire visual range. He found that on Apr. 27 and Apr. 29 the comet's surface was brightest in the middle of the green region of the spectrum. The average intensity values on the A.L.P.O. Scale (0 darkest and 10 brightest as compared to the total intensity of the coma) according to Wegner were:

Red	0	
Orange	0 to 2.5	
Yellow	2.5 to 6.0	
Green	6.0 to 8.0 to 7.0	Apr. 27 and
Blue	7.0 to 5.0	Apr. 29, 1960.

This result bears out the strength of the photographic image on these dates. Wegner's observations were made using filters visually with a 10-inch reflector.

B. Spectral Observations

In addition to colorimetric estimates, Wegner obtained a visual

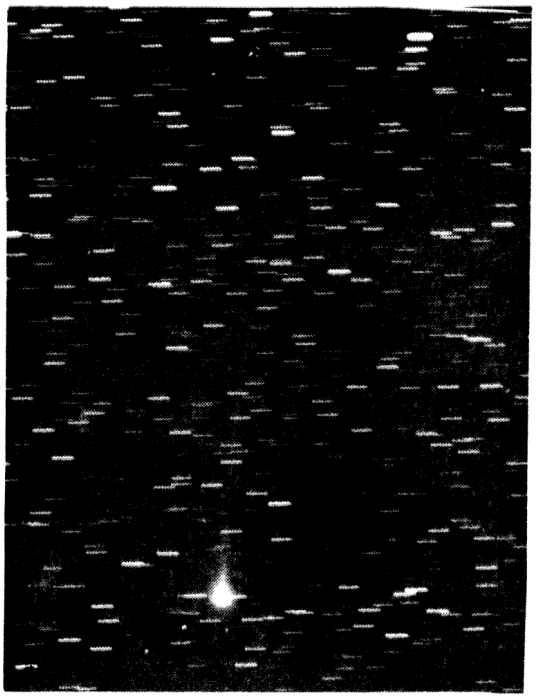

FIGURE 5. Red-sensitive photograph of Comet Burnham, 1959k, by Alan McClure. 4-inch f/5.0 Goto refractor. April 22, 1960. 10 hrs., [illegible] mins. - 10 hrs., 56 mins., U.T. on a 103 a - E plate with a 23 a filter. Note scarcity of stars compared to Figure 6 in blue light.

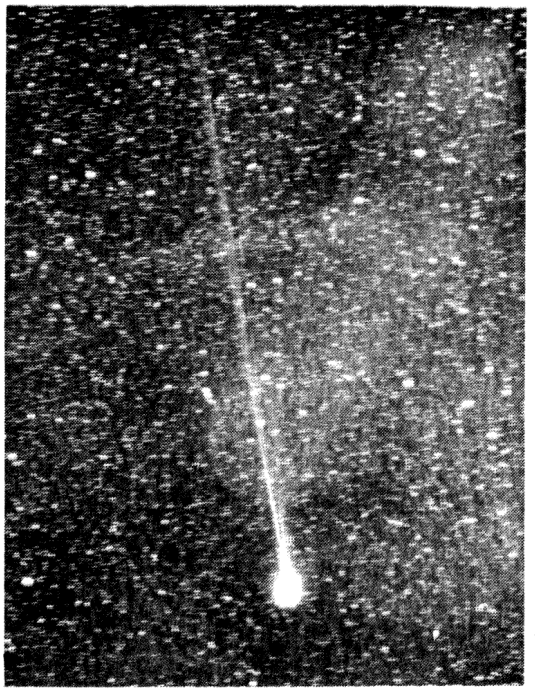

FIGURE 6. Blue photograph of Comet Burnham, 1959k, by Alan McClure. 5.5-inch f/5.0 Zeiss Triplet. April 22, 1960. 11 hrs., 0 mins. - 11 hrs., 25 mins., U.T. No filter (?). 103 a O plate (?). Compare to Figure 5 in red light, and see discussion in text of Mr. Meisel's article.

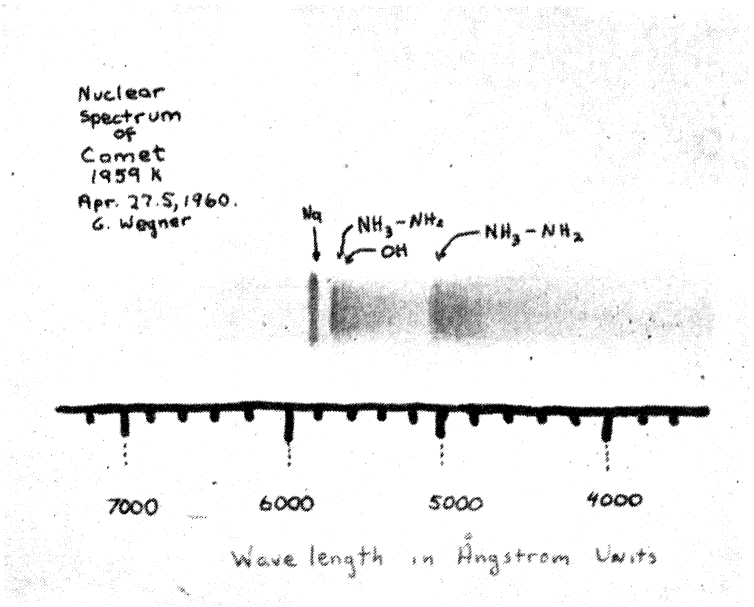

FIGURE 7. Sketch of nuclear spectrum of Comet Burnham, 1959k. Adaptation by David Meisel of original spectrum sketch by Gary Wegner. April 27.5, 1960, 10-inch Cassegrain reflector; transmission grating 13,400 lines per inch, slit width 1/300 inch. See text for details of line and band identification.

spectrum drawing. This drawing shows the spectrum of the nucleus and the surrounding area. (See Figure 7.) Plainly visible were the sodium D doublet in emission and two molecular band systems. The observation was made with a slit spectrometer using a transmission grating. The fact that the sodium $^2P - ^2S$ transition was visible at such a large heliocentric distance of more than 1 A.U., is a bit unusual. However, this emission can be explained fairly easily if one goes back to the photometric data. At the time the spectrum was obtained the comet was at the peak of one of the short term brightness increases. In Part III it was postulated that these fluctuations were caused by particle bombardment. The presence of the Na emission lends more support to the argument. The green tint of the colorimetric data could be accounted for by this emission. The Na lines were by far the brightest visually. However, the two band systems were noticed as fairly plain but faint. Tentative identification of the band systems was possible. System I started at about 5700 Å and was identified to be a mixture of $NH_3 - NH_2$ bands with OH bands. System II started at 5050 Å and was identified with the second series of $NH_3 - NH_2$ bands. No red emissions were detected above the general continuum. (See Figure 7.)

Mr. McClure and Mr. Wegner are to be congratulated for their work. Others who possess the proper equipment are encouraged to attempt similar programs. It is only through the cooperation of all interested amateurs that these reports are possible.

C. Unusual Observations
I. Coma and Tail Structural Pecularities

Close examination of McClure's photographs shows the existence of a weakly lighted diffuse area associated with the portion of the coma located some 30 degrees in position angle sunward from the main tail. This feature is present in the red plates as a broad diffuse fan, the width of the coma. It was photographed on Apr. 22 and 29 and on May 1. A similar appendage was observed by Meisel visually on Apr. 20. It is suspected that this feature is the broad curved tail reported by Roemer during the preperihelion period. Since it is more evident in red light, it is probably a tail of meteoric material or dust ejected from the interior of the comet.

Careful measurement of the relative dimensions of the coma show that the coma was consistently elliptical with its major axis perpendicular to the axis of the main tail. At 45 degrees angle to the tail axis, Wegner and Hartmann both recorded faint jets of material being ejected from the nucleus. Wegner's observation on May 1 shows the two jets entirely within the coma. On May 2 Hartmann shows the same features, only now much longer and extending out of the inner coma.

In the I.A.U. Circular No. 1726, J.B. Tatum of the University of London Observatory reported a curious depression in the coma opposite the tail. This feature was recorded photographically on Apr. 27 and May 4. No mention of it was made on Apr. 28 and 29, although the coma appeared more centrally condensed on those dates. One gets the impression that a stream of material or radiation pushed the coma in and shoved the coma material out into the tail. It should be noted that solar activity was at a high peak during this interval, and the intersection with solar material is highly probable.

On Apr. 29 McClure took two blue sensitive plates of the comet, the two being separated by two hours. In the earlier plate, the main tail and a smaller secondary tail were plainly visible. The main tail appeared broader than usual with some ray structure. Two hours later, the small secondary tail could not be detected at all; and the main tail was now much narrower. A dark rift in the main tail in the earlier exposure was on the left of the tail axis. In the later exposure, the dark rift was gone on the left side but a narrow dark rift was plainly visible on the right side of the tail axis. This change seems indicative of either

rapid twisting of the entire tail or magnetic interaction of the tail particles causing rapid contractions. More information is needed to determine which. Either explanation has its drawbacks.

Additional peculiarities are discussed by Charles Bertaud, of Meudon Observatory, in the I.A.U. Circular No. 1726 (translation of French):

> ". . . the tail having a length of $4^{\circ}.6$ is threadshaped at the junction of the coma and is widened at the end after $1^{\circ}.5$ . . . the thin and scarcely curved tail expands slightly toward the end, its boundaries are well defined from the junction to the coma, on. To the north, there is a large region of several degrees in area and weakly illuminated by the presence of gas or dust. On April 29 the phenomenon, which appeared remarkable, is still visible . . . April 22nd this luminous region already existed, weaker, bounded by the tail but south of the latter. (Observation confirmed by a photographic plate taken by R. Weber on the same date.) . . . "

It is assumed that this object is the same feature as described earlier (dust tail).

From the I.A.U. Circular No. 1729, Dr. R.L. Waterfield comments:

> " . . . The tail where it emerges from the coma is about 1' of arc wide and forms a narrow cone that subtends an angle of $2\frac{1}{2}^{\circ}$ (at the center of the coma). The narrow root of the tail can be traced through the coma to within about $2\frac{1}{2}'$ of its center . . .
>
> "On the second and third plates obtained on the night of Apr. 26-27 a stretch of the northern edge of the tail about 30' in length and about 8° from the nucleus is clearly brighter than the parts of the edge on either side. In the eighty minute interval between these two exposures this linear intensification of the edge of the tail has undoubtedly shifted by 20' to 25' in the direction towards the head. Unfortunately, the first plate taken that night gives no certain confirmation as the suspected linear feature falls on the edge of the plate. This phenomenon if confirmed would suggest that the comet, which was traveling tail foremost,was passing through a stream of particles capable of exciting the gases of the tail."

It is interesting to note that some hours after this, Wegner recorded the definite Na emission; and a short-period brightness outbreak was taking place. One wonders if these events are somehow connected and if so in just what manner.

II. Possible Star Occultation

R. V. Ramsay of the Toronto Centre, RASC, has submitted a copy of the Summer, 1960 Scope, which contains a description of his observation of a possible occultation of a star by Comet 1959k. The observation was made with a 3.25" refractor at 72X. The occultation was observed while the star was passing through the outer edge of the coma. Approximate duration of the minimum phase was 15 minutes. The time of minimum was May 2, 1960 at 4:05 U.T. To date, this is the only report that has been received on this phenomenon. Anyone who possibly has observations on or near this time is urged to submit them to the Recorder. There is yet to be a case of star occultation by a comet substantiated by simultaneous observations. It would be highly desirable to determine if such phenomena actually occur.

The Recorder would like to express his gratitude to all those who submitted observations and material used in this Report. In addition, the Recorder would like to thank Director Haas for his patience and goodwill during the production of this manuscript.