A SIMPLE COMET PHOTOMETRY TECHNIQUE

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I. INTRODUCTION

By far the most popular type of photoelectric photometry is that of variable stars. Some work is done on galaxies, planets, and asteroids. A real challenge is presented to those interested in occultation photometry of stars by solar system bodies. However, comet photometry is in the minority. This is due mainly to the small number of comets, their unpredictability, and difficulty with techniques. The approach of Comet Halley offers a unique opportunity to prepare for some comet photometry. In addition, the comet promises to be an easy one (compared to most) as its parameters such as position and brightness are fairly well known (Browne 1985). A simple scanning technique plus a solid-state photometer head are described in this paper, to show an easy approach to comet photometry. In fact, the telescope does not need an equatorial mount, let alone a clock drive.

II. THE TECHNIQUE

Either analog or photon-counting photometry can be used, although the analog method with a chart recorder provides instant data plots. The photon counting requires manual plotting of data or interfacing with a computer for data manipulation and printout. Both techniques have their advantages. The method described in this paper uses the analog technique with a chart recorder. The technique involves using a small diaphragm to scan across the comet. By pointing the telescope and diaphragm ahead of the comet in right ascension and letting the turning of the Earth sweep the telescope and diaphragm across the comet's image, a cross section of the comet's projected surface brightness can be obtained. This is then repeated at different declinations to produce a composite of sectional sweeps across the comet. These resulting plots are brightness (amplitude) vs time (size) and represent a picture of the comet.

By inserting an interference filter in front of the detector and again sweeping across the comet at different declinations, useful information about the whole comet's composition can be obtained. Interference filters for comet photometry are available from Lumicon, 2111 Research Drive, No. 5, Livermore, California 94550, telephone 415:447-9570. The C_2 filter has 55% transmission at 5140A and a FWHM bandpass of 90A and costs $ 79.00. The Continuum filter has 55% transmission at 845 + 10 A and a FWHM bandpass of 65 + 10 A and costs $ 79.00. The filters are 1.00 + 0.01 inches in diameter, 4 - 6 mm thick, and are fully blocked from the ultraviolet to the infrared. A set of the two costs $ 139.50.

III. OBSERVATIONS PLANNED

A simple (sliding roof) observatory will be constructed at a dark site located about 100 miles north of Phoenix on Spruce Mountain at an elevation

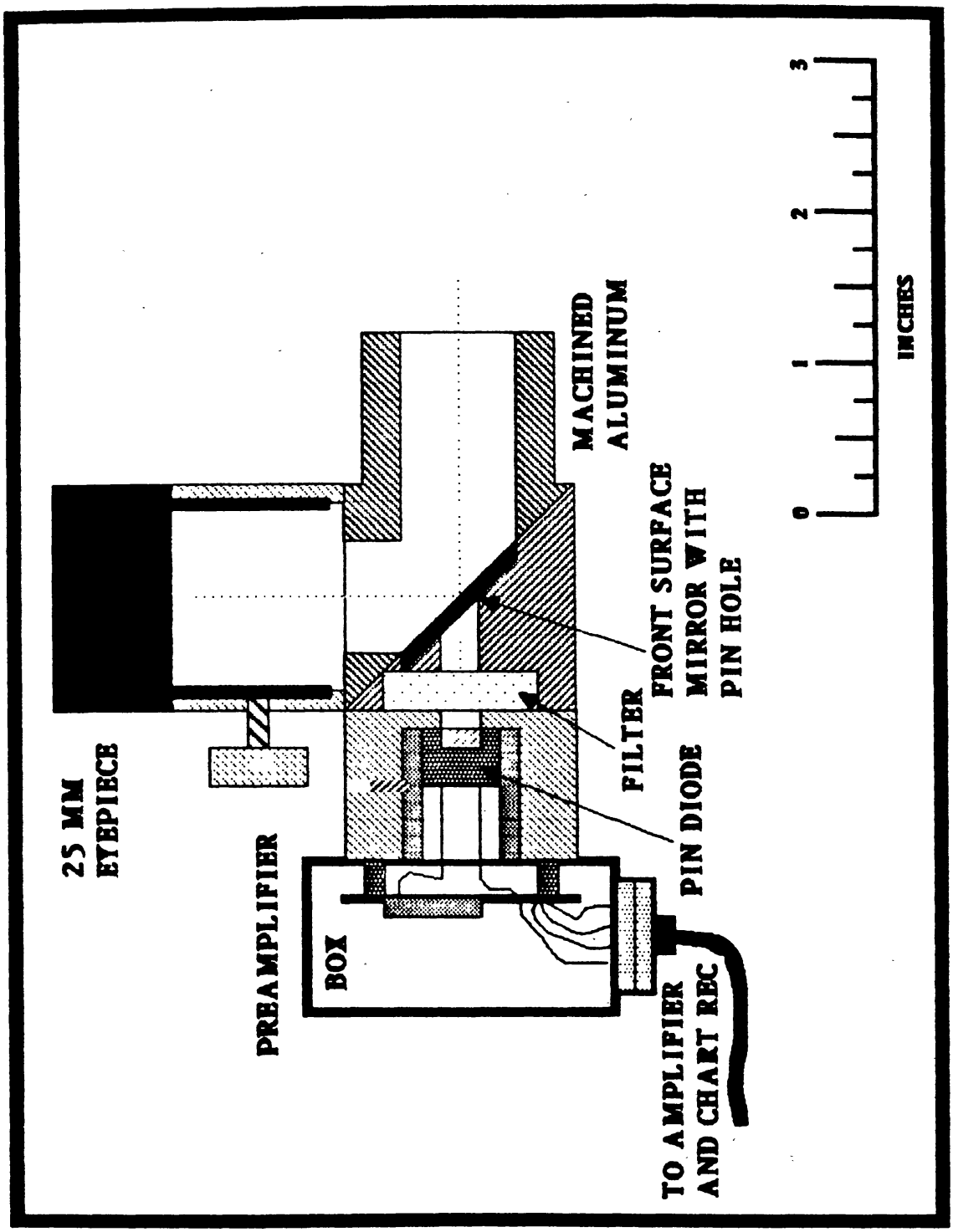

Figure 1. Single-channel comet photometer head.

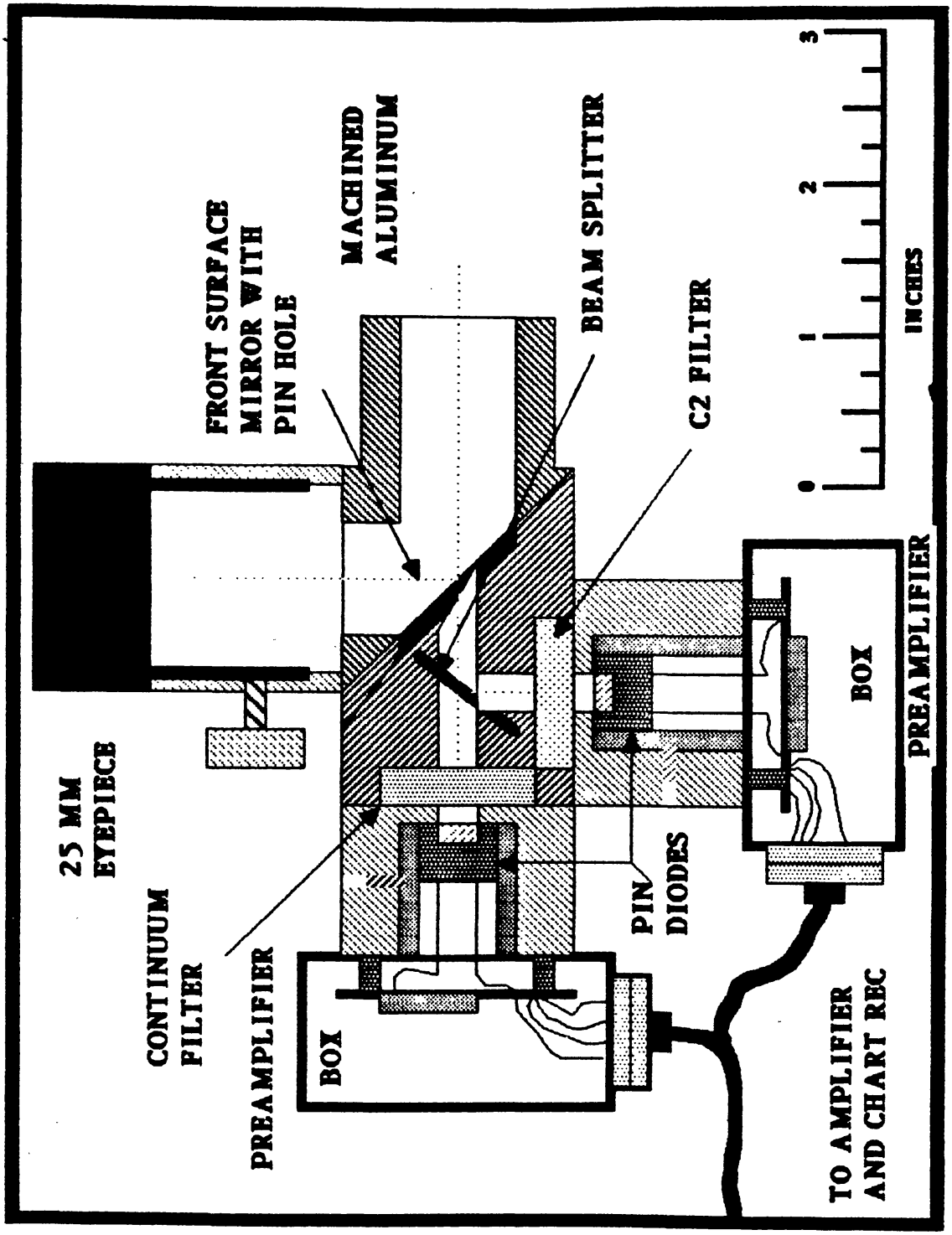

Figure 2. Dual-channel comet photometer head.

of 7500 feet. This site provides an excellent view to the south and thus is ideal for observing Comet Halley. A 13.1-inch Dobsonian telescope with a solid-state detector will be used. A chart recorder will record the data and a portable generator will provide power.

For occultation work the 8-inch Celestron telescope at the Hopkins Phoenix Observatory back in Phoenix will be used. A photon-counting system interfaced to a computer will record the data and timing.

For additional reading on comet photometry I recommend the excellent paper by A'Hearn (1983).

IV. A SIMPLE SOLID-STATE COMET PHOTOMETER HEAD

Figure 1 shows the photometer head. The unit is machined from aluminum and is anodized black. The whole photometer head extends less than 4 inches from the telescope's eyepiece holder (Tardif 1983). A PIN diode is used as a detector. Filters can be inserted into the side of the head and held in place by a small piece of foam and black electrical tape. A front surface mirror has a small hole in the reflective coating to act as a diaphragm and provide a view to the eyepiece. A 25-mm eyepiece is used to locate the comet and position the telescope for the scans.

Figure 2 shows a dual-channel photometer head. Both the C_2 and Continuum filter can be permanently mounted in the head and used simultaneously. This has the advantage of being able to compare the data directly through both filters at the same time. This would require two amplifiers/chart recorders or the use of a dual-channel computer input. Work is being done on using the Commodore C-64 for this purpose.

Interest has been expressed in making several of these units for observers. Anyone interested should contact me. It is estimated that the machined and anodized part can be produced and sold for cost; the price would be $ 150 for each single-channel and $ 200 for each dual-channel. This would not include the detectors, preamplifiers, filters, mirrors, or eyepiece.

Comet Halley provides a unique opportunity for the amateur photometrist to make a significant contribution to astronomy. With a little effort the transition from stellar photometry should be easy. Don't let this opportunity pass you by.

For more information, contact either Stephen J. Edberg or Ray L. Newburn, Jr. of the International Halley Watch (MS T-1166, Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, California 91109) or Dr. Jurgen Rahe (Director, Remeis Sternwarte, Sternwartestrasse 7, D-8600 Bamberg, West Germany). Comet photometry data should be reported to Dr. Michael F. A'Hearn (Astronomy Program, University of Maryland, College Park, Maryland 20742, telephone 301:454-6076).

REFERENCES

A'Hearn, M. F. 1983, in Solar System Photometry Handbook, edited by R. M. Genet (Richmond, Willmann-Bell), ch. 3.

Browne, R. 1985, Astronomy 13, No. 2, 75.

Tardiff, A. 1983, I.A.P.P.P. Communication No. 12, 41.