STANDARD STARS FOR COMET PHOTOMETRY

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ABSTRACT. Photoelectric photometry of comets is a feasible and worthwhile research program for small telescopes. Nine filters designed to isolate selected emission features and continuum regions in cometary spectra have been adopted by the IAU as those recommended for comet photometry. Magnitudes of standard stars for the IAU filter system have been derived. The results have been compared with previous observations and transformations to place all observations on a common system obtained.

1. INTRODUCTION

A profitable research program for small telescopes is the photoelectric monitoring of comets. Because comets appear suddenly and most studies require measurements made over an extended period of time, observations with larger, heavily scheduled instruments are often impossible. Furthermore, comets are extended objects and for projects involving the comet's integrated brightness a small scale is preferable. We have established a system of photoelectric standards intended for comet photometry.

2. COMET PHOTOMETRY

Comet photometry can be divided into two types: studies of the continuum and studies of emission lines. Continuum observations are directed toward understanding the dust component of the comet, and ideally only involve measures of reflectivity of the solar spectrum. The emission line studies are concerned with the production of the components of the

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gas, and ideally involve only measures of the emitted flux of a particular species as a function of solar distance. In practice, the two types of studies are intertwined.

In order that observations be standardized, IAU Commission 15 has adopted a set of filters recommended for photoelectric observations of comets. Briefly, the set consists of five primary and four secondary filters selected to measure various emission features and continuum points. A large number of IAU filter sets have been distributed to observers worldwide through the International Halley Watch in preparation for the current appartition of Comet Halley.

3. STANDARD STARS

The adoption of a filter system for comet photometry necessitates the establishment of a system of photometric standards. Two classes of standard stars are required. First, one must have G-type stars that mimic as closely as possible the solar spectrum for use in the continuum studies. Second, one needs flux standards, usually chosen to be B stars because of the few spectral lines, to calibrate the emission line fluxes. Obviously, the standard stars must be distributed in right ascension, and it is preferable if they are equatorial stars accessible from observatories in both hemispheres. At the same time, comets often are observable only for a few hours near dawn or dusk and at high air masses. This mandates standards close to the comet in the sky, and it is therefore usually also necessary to have a set of secondary standards located along the path of the comet.

A set of primary standard stars for comet photometry has been suggested by A'Hearn (Solar System Photometry Handbook, 1983). Seven solar analogs were selected as the G standards and twelve early B stars chosen as flux standards. Secondary standards, of course, need to be chosen for each comet. Examples of secondary standards are the list of Comet Halley stars selected by A'Hearn, Vanysek, and Campins (International Halley Watch Newsletter No. 4, 1984).

4. OBSERVATIONAL MATERIAL

We have obtained observations of A'Hearn's suggested primary standards and Comet Halley secondary standards using the IAU filters. The northern Hemisphere observations were obtained at Lowell Observatory employing the 0.6-meter and 1.1-m reflectors. The southern hemisphere observations were made at the Perth Observatory with a 0.6-meter reflector. These data are available from the authors.

A comparison of our results with the IAU comet filter observations of Wisniewski and Zellner (Icarus 63,333, 1985) shows good agreement, averaging .025 mag. after correction for different zero points. The agreement with the preliminary results of Vanysek and Wolf is less satisfactory, averaging 0.08.

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