OBSERVATIONAL DIFFERENCES BETWEEN HUMAN EYE AND PHOTOELECTRIC VISUAL PHOTOMETRY

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Abstract

Visual observers are sometimes upset to discover that their visual estimates do not agree with photoelectric values. This paper will help visual observers understand how this can occur, and will give them greater confidence in their own data.

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It is said that photoelectric photometry is an accurate and reliable means of studying variable stars. From my own experience, this is not necessarily true when the results are compared with data from visual observers. It is possible that the visual observers has had the experience of doubting the accuracy of some PEP data when compared with what his observations show. Or depending on his personality, length of observational experience, etc., he may tend to lose confidence in his work. In order to obtain a better understanding of the problem, let us look at a couple of problems and then discuss a little cooperative observing project some AAVSO visual observers did with me.

A few years ago I was involved in measuring sequence stars for the AAVSO Chart Committee. My values for the FU Orionis chart were good; the visual observers could agree with my PEP data. But the next project, FG Sagittae, had several problems that were never resolved, in spite of much time spent by me trying to find the reasons for the discrepancies. One prime problem was that PEP gave star B as brighter than star E, but all of the visual observers that were checking it said that just the opposite was true! So we just had to give up on that one.

Another example relates to a remark made to me by an experienced visual observer. After comparing my PEP light curve of Nova Vulpeculae 1976 with his light curve, he wished there could be a way for him to correct his observations to PEP values. I replied that he would probably be wasting his time and that there was really nothing wrong with his data anyway.

In June 1975, I started a small observing project hoping to be able to shed some light on the sequence-star problem. A chart was made of a selected group of stars with a range in spectral class from A0 to M0. PEP magnitudes were given for each star, which ranged from $5^{m}.4$ to $7^{m}.0$. A note went with each chart to several experienced visual observers requesting that they critically examine the sequence and to make any changes to the values they felt were wrong. Seven observers replied with their results, the means of which are shown in Figure 1. Individual results are given in Table 1. The horizontal axis represents the spectral classification of the various stars observed and the vertical axis represents the deviation in magnitude between PEP and the visual observer's means. The A0 star was reported to be $0^{m}.05$ brighter than the PEP value, the F8 star was reported to be the same as the PEP value. From there on, toward the redder stars, the visual observers gave progressively lower values than PEP, with a difference of $0^{m}.3$ for the M0 star.

The PEP Visual filter rejects normally-visible blue light, but responds well to yellow and red light. The A0 star was blue enough so that PEP V filter saw it $0^{m}.05$ fainter than the eye did --

the V filter cut off that much light. The dark-adapted eye is most sensitive to green light and its sensitivity drops off more rapidly toward the red than PEP visual does. So the PEP values are brighter for red stars than is reported by the visual observers. Also note that Nova Vulpeculae 1976 was quite red, so the difference between my friend's visual light curve and that from the PEP was considerable.

So it appears that one solution to the star sequence problem might be to restrict the range of the spectral class of the stars included in any one sequence. That is not desirable because it would be necessary to locate stars farther away from the variable than is now done, in order to find enough with similar color and appropriate magnitudes. We might find a filter for the photometer that would match the "average" eye, but then those PEP observations could never be transformed into the standard UBV system. Likewise, the visual observer could attempt to observe through a filter that might bring his results close to PEP, but unless all observers were using the filter it would be advisable not to send any of those to Headquarters.

To me it seems best for us to just continue observing in the same manner as we have in the past and to not get too concerned when PEP and visual estimates are at odds. Just remember that the eye is not a photometer, and vice versa; but recognize that either instrument, when properly applied to a telescope, can obtain useful information from the stars.

TABLE 1

VISUAL ESTIMATES AND PHOTOELECTRIC MEASURES

SAO No. of Stars Obs'd	284388	284005*	284413	284408	284346	284291	284375
Delta Mag. Visual Obs. Vs. PEP V	-0.05	---	0.00	0.16	0.17	0.31	0.31
Means	7.04	5.40	6.23	6.25	5.71	6.63	6.12
Obs. 7	7.2	5.4	6.5	6.5	5.8	6.9	6.4
Obs. 6	7.1	---	6.1	6.0	5.6	6.4	5.8
Obs. 5	7.0	5.4	6.4	6.2	5.8	6.7	6.3
Obs. 4	7.0	5.4	6.1	6.3	5.8	---	6.0
Obs. 3	7.0	5.4	6.2	6.2	5.7	6.8	6.3
Obs. 2	7.0	5.4	6.0	6.1	5.7	6.4	6.0
Obs. 1	7.0	5.4	6.4	6.4	5.6	6.6	6.1
PEP V Magnitude	7.09	5.38	6.23	6.09	5.54	6.32	5.81
Spectral Class, SAO	A0	A5	F8	K0	K2	K5	M0

*The brightest star, SAO 284005, was adopted as a zero-point by all observers, so its "Delta Mag." is, by definition, zero, and this value is plotted with an open circle.

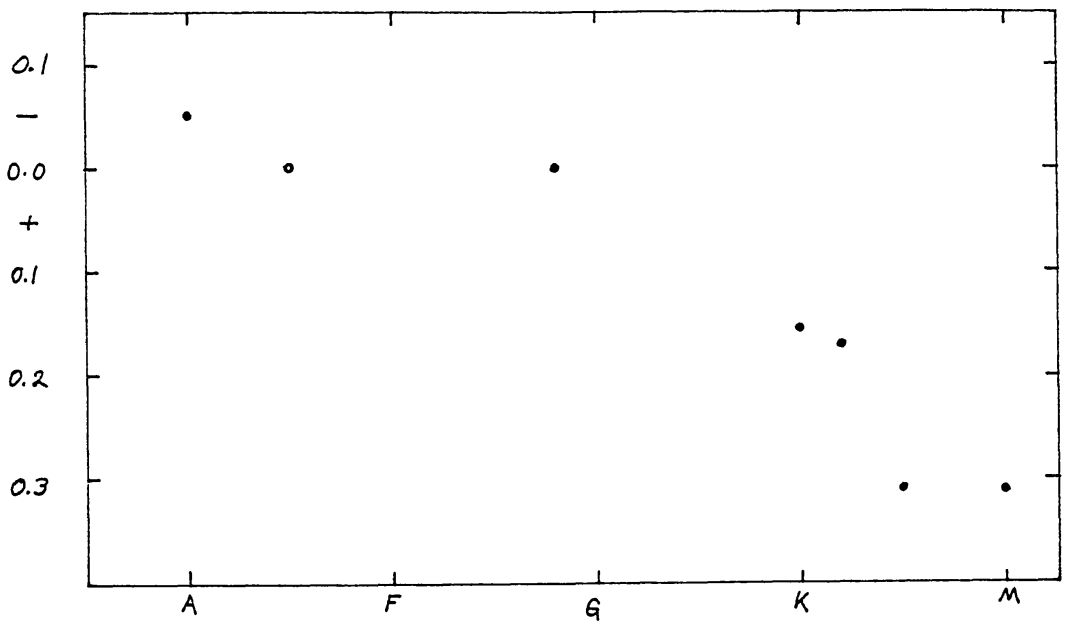

Figure 1. Deviation in magnitude between Photoelectric V and visual observer's estimates versus spectral class of stars.

THE N.C.A. NOVA PATROL PROGRAM

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ABSTRACT

The Nova Patrol of the National Capital Astronomers, Inc., represents a systematic program of the search and discovery of galactic novae. It is being conducted in cooperation with the Nova Search Committee of the AAVSO. This activity is the continuation of a program begun by the N.C.A. in 1958. At present we have three observers and two verifiers in our group.

The major part of our work consists of patrolling AAVSO Search Areas 42 and 54. These fields were chosen so that at least one is above the horizon at any time of the year.

We presently use two different methods to search for novae. The first technique consists of visually scanning the fields with binoculars down to 7th magnitude. The second method consists of regularly photographing the fields.

The future plans of our program include an expansion of our work to more fields, especially the so-called "Common Areas." We are also involved in constructing special nova patrol charts to be used in quickly locating and memorizing star patterns in the fields.