

MULTI-SITE PHOTOELECTRIC OBSERVATIONS OF VARIABLE STARS AND SEARCHING FOR CLUSTER FLARE STARS

Arthur A. Page

Dept. of Physics, University of Queensland,
and Mt. Tamborine Observatory
Australia

*Presented at the First European Meeting of the AAVSO
Brussels, July 24-28, 1990*

Abstract

Photoelectric and photographic variable star programs in Australia are described.

1. Photoelectric Photometry of Variable Stars

The author and his late wife, Beres Page, first established a private observatory at North Chermside, Brisbane, Australia, in 1964, to be used for the monitoring of solar-neighborhood flare stars in association with the Radiophysics Division of the CSIRO, Mt. Stromlo, Siding Spring Observatory, and other observatories collaborating within the program organized by the Working Group on Flare Stars, Commission 27 of the IAU. In 1966, the Pages constructed a 0.20-m/0.32-m f/3 Schmidt telescope to improve the quality of observations with a faster instrument.

Following the death of Mrs. Page in 1970, the author established a new observatory at Mt. Tamborine, which is situated some 90 road kms south of Brisbane, and 20 kms due west of the Gold Coast township of Surfers Paradise in the Darlington Range at an altitude of 560 m. At this time, funding was obtained from the Science and Industry Endowment Fund (SIEF) to construct a substantial mounting capable of supporting a photoelectric 32-cm Cassegrain telescope. (The SIEF was designed to assist non-academic scientific contributors.)

In 1977 the photographic program was terminated, and in 1978 funding was obtained for the procurement of a single-channel Pacific UB_V photometer. In 1981 a post-graduate student from the Department of Physics, University of Queensland, was assigned to construct a filter-wheel rotator and integrator to improve the data output. In 1982, after further funding, the photometer was interfaced with a Z80 computer. The student, meanwhile, had been assigned to the Observatory for some of his field work. In 1986 further improvements were made to the coupler-filter wheel. In 1987 the SIEF provided funding for an XT + 8086 co-processor. In that year the author was appointed as Honorary Research Consultant to the Dept. of Physics where consequently data-logging processes have been completely upgraded. The photometer provides 12-bit parallel voltage every 300 milliseconds; it is displayed on the digital window as well as being traced by a chart recorder.

The software logs the data and computes relevant data such as real-time light curves for the respective filters (presently being converted from UB_V to UB_VR_I), σ , and air-mass.

Mt. Tamborine Observatory has, for the past 12 years, participated in many multi-site collaborative programs involving flare stars and some eclipsing binaries. Recently, this included participation in the MUSICOS variable star observational program. Other

multi-site collaborative programs included the partly successful photoelectric observations of the occultation by Neptune in 1983, Halley's Comet in 1986, and the successful observation of the occultation of Pluto in June 1988.

2. Searching for Southern Cluster Flare Stars

K. L. Jones and A. A. Page commenced this program in 1987. It is our aim to endeavor to discover flare stars in southern open clusters, with a view to finding a sufficient number which would constitute suitable objects for multi-site CCD observational programs. To date, we have found two flare stars in the region of IC 2391, one in Blanco 1, and ten positive and one possible in Messier 7. Until 1983, most of the known open-cluster flare stars were residents of the Pleiades, the Hyades, or the Orion nebula complex. In 1984 McConnell and Mermilliod found one in IC 2391.

We conduct our photographic observations using multiple-exposure techniques with the Uppsala Southern Schmidt Telescope. Four exposures, each of 10-minute duration, are taken using Kodak 103aO plates behind a GG385 filter (see Figure 1). These plates are then carefully scanned under a stereo-microscope and suspects indexed. These are then identified on master plates obtained for each of our fields. We also obtain plates for photometric estimation of our suspects, each such plate containing four exposures each of 2.0, 18, 180, and 1800 seconds. The suspects are then measured for photometric equivalence with these images of stars of known photographic magnitude, the estimate being read off to an accuracy of 0.2 magnitude, which is sufficient for identification purposes. The suspects are then identified on the master plate on which are also identified known stars whose positions have been catalogued. The plates are then measured with the Zeiss measuring engine at the Anglo-Australian Telescope (AAT). These data are then processed by means of AAT software to provide the coordinates for the suspected flare stars. We conduct four observations per year with the Uppsala Schmidt. We have obtained a total of 120 plates.

We have also commenced a long-term photographic search for southern variable stars, also using the Uppsala Schmidt with 103aG plates behind a GG480 filter. The Department is constructing (and at present has half-completed) a blink-comparator designed by the author. It will ultimately be fitted to provide plate comparison by CCD projection as well as direct measurement.

References

- Gurzadyan, G. A. 1980, *Flare Stars*, Pergamon Press, Oxford.
- Haisch, B. M., Linsky, J. L., Slee, O. B., Siegman, B. C., Nikoloff, I., Candy, M., Harwood, D., Verveer, A., Quinn, P. J., Wilson, I., Page, A. A., Higson, P., and Seward, F. 1981, *Astrophys. J.*, **245**, 1009.
- Jones, K. L. and Page A. A., "Search for Southern Cluster Flare Stars," in *3rd New Zealand Photoelectric Conference* (in publication).
- Kunkel, W. 1973, in *Variable Stars and Stellar Evolution*, IAU Symposium No. 67, eds. L. Sherwood and V. Plaut, D. Reidel, Dordrecht, 15.
- Nelson, G. J., Robinson, R. D., Slee, O.B., Fielding, G., Page, A.A., and Walker, W. S. G. 1979, *Mon. Not. Roy. Astron. Soc.*, **187**, 405.
- Page, A. A. 1967, *Proc. Astron. Soc. Australia*, No 1.
- Page, A. A. and Page, B. 1968, *J. Brit. Astron. Assoc.*, **79**, 26,
- Page, A. A. and Page, B. 1970, *Proc. Astron. Soc. Australia*, **1**, 324.
- Page, A. A. 1982, *I.A.P.P.P.* No. 6.
- Page, A. A. 1987, *Atlas of Flare Stars Within The Solar Neighbourhood*, Dept. of Physics, University of Queensland.

Page, A. A. 1988, *Astronomy Now*, 2, 26.

Page, A. A., "Photoelectric Photometry at Mt. Tamborine Observatory," in *3rd New Zealand Photoelectric Conference* (in publication).

Slee, O. B. and Page, A. A., in *Trends in Variable Star Research*, IAU Colloquium 47, eds. F. M. Bateson and J. Smak, Hamilton, New Zealand.

Slee, O. B., Allen, W. H., Coates, D. W., Page, A. A., and Quinn, P. J. 1981, *2nd Asian-Pacific Regional IAU Conference*, Bandung, Java.

Sterken C., Vogt, N., Freeth, R., Kennedy, H. D., Marino, B.F., Page, A. A., and Walker, W. S. G. 1983, *Astron. Astrophys.*, 118, 325.

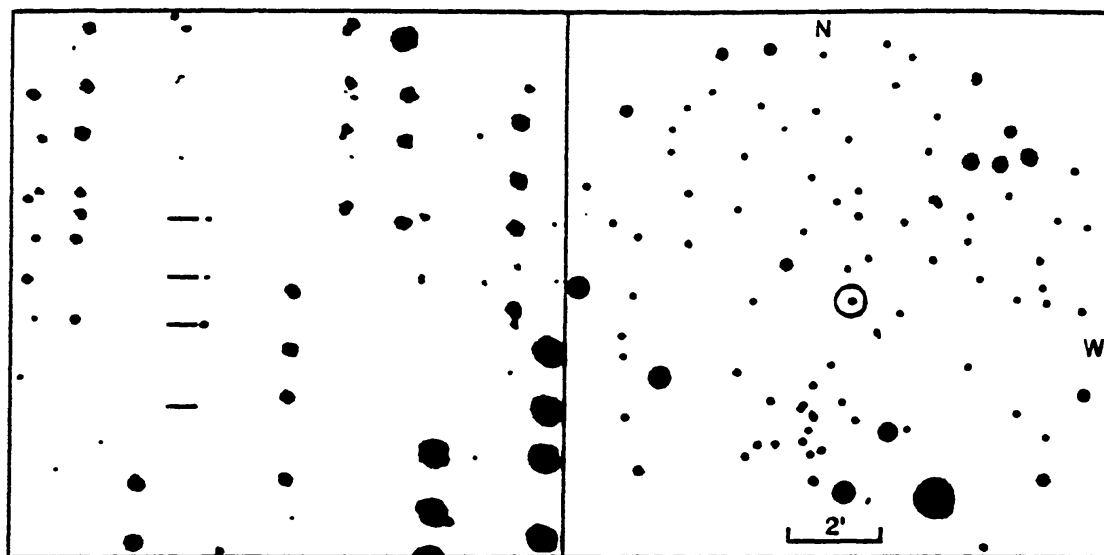


Figure 1. Typical multiple exposure photo showing flare star (left) and finder chart (right).