

EARLY RESULTS FROM THE MICHIGAN SOUTHERN-HEMISPHERE SPECTRAL SURVEY

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(Read by C. B. Stephenson)

Abstract. This paper discusses the present status of a preliminary inspection of the plates obtained in the Michigan objective-prism survey of the entire southern sky. A very large number of peculiar stars, and of normal supergiants as well, have been noted and lists of these are being prepared for publication.

When the Curtis Schmidt-type reflector began operations at Cerro Tololo in the spring of 1967 the main program undertaken by University of Michigan personnel with the telescope was a systematic objective-prism coverage of the entire southern sky in the blue spectral region with the highest available dispersion, approximately 108 \AA mm^{-1} at H γ . This program is now some 90% complete, and observations are being extended to the northern sky accessible from Chile. Most of the plates were taken by MacConnell, and the entire project has continually had his immediate supervision.

The complete exploitation of the beautiful spectrographic material obtained in Chile will undoubtedly take many years. One phase of this work is the ambitious, but feasible, determination of accurate spectral types and luminosities for the southern stars of the *Henry Draper Catalogue*, so capably being attacked by Miss Nancy Houk, which you have heard described already. But even in the early stages of the plate-taking it was clear that it would be comparatively easy to pick out on this material such interesting and important objects as Ib or brighter supergiant stars, late-type dwarfs, emission-line and other multitudinous peculiar stars, to a considerably fainter limiting magnitude than that of the H.D. catalogue. Thus we began as soon as the plates became available to systematically scan them for such objects. The *modus operandi* was the following:

(1) The plates were first scanned by eye as carefully as possible and all objects thought to be of interest were marked and their classifications or peculiarities noted. The supergiants were classified with the aid of prints from the MKK and other atlases, slit spectral material and occasional Schmidt standard-star spectra previously obtained at Michigan. The peculiar stars were noted in most cases *ab initio*. In the course of time, of course, various peculiar stars served as standards for their respective types. This preliminary scanning was done largely by several skilled Michigan graduate students and to some extent by MacConnell. Those participating in this phase of the

work were Bond, Schmitt, Humphreys, and finally, Frye, who has been responsible for the bulk of this work.

(2) The second stage of the work consisted of an inspection by Bidelman of all of those objects marked in stage 1, in the course of which a definitive classification of the various objects was decided upon. In this, appreciable changes were often made in the preliminary classifications and indications of abnormality and many doubtfully peculiar objects were rejected. It should be pointed out that this work was largely done without use of spectral standards, and it is inevitable that substantial errors exist in the results. Some of the presumed supergiants will not prove of high luminosity, and some of the supposed peculiar stars will not prove peculiar, but it is hoped that the number of errors is low. It is also worth specifically noting that if an interesting object were missed in stage 1 it would almost invariably also not have been picked up in stage 2. Thus one may well expect there to be many interesting objects yet left on the plates. This is especially true of marginally peculiar stars that can only be noted by careful use of standards.

(3) The final stage is the determination of coordinates for the objects retained in stage 2, their identification in various catalogues, and their publication.

The present status of this so-called 'early result' program is as follows:

Preliminary scanning (stage 1) has been completed for nearly all of the plates so far obtained, so that exceptionally interesting objects can be noted without undue delay. Bidelman's inspection (stage 2) has been completed for the plates taken through August 15, 1969, which included a coverage of approximately 81% of the southern sky (1003 plates of 922 separate fields). According to present plans his participation in this program will cease at this point; thus every effort is being made at the moment to complete the identifications (which have proved the most time-consuming part of the project, since many important objects are not in programmed catalogues), for those stars that have been checked by him. Carrying on the program for the remainder of the southern plates and for the northern plates now being obtained will be the responsibility of the University of Michigan personnel.

In the preparation of the material for publication emphasis has been placed on publishing only new discoveries. There seems little point in including in our lists southern supergiants already classified (presumably more accurately) on slit spectrograms, or already known cepheids, peculiar objects or emission-line stars. Thus known unusual objects have in general been deleted from our final catalogues, which are now in course of preparation. Preliminary lists of various types of objects discovered have already been distributed to many interested astronomers, and a considerable number of stars of special interest have already been noted in the literature (*IAU Circ.* Nos. 2089, 2120, 2130, *Astrophys. J. Suppl.* **22**, 117, *Publ. Astron. Soc. Pacific* **82**, 730 and 1360; **83**, 98 and 485).

Final figures for the numbers of *new* objects of various types that have been found in the "early result" program are not available since the identifications are still incomplete, and thus many at the moment undetermined duplications exist among the various plates as a result of intentional plate overlap and the necessary re-taking of

occasional poor plates. Very rough figures which in a few cases are probably fairly close to the final totals but which in others are far from final are:

supergiants	251	weak-line stars	151	BaII stars	175
Be stars	52	hor.-branch stars	10	br CaII giants	59
Ap stars	326	carbon stars	14	no-Gbd stars	29
Me (LPV)	32	CH stars	3		
shell stars	10	S stars	10		
He-rich	7	white dwarfs	1		
H-poor	3	dMe	4		
H + Ca II emission	7	H + $\lambda 4686$ em.	8		

The numerous composite, metallic-line and δ Delphini stars and late type dwarfs noted on the preliminary scanning of the plates will not be included in our lists but will be discussed by others. It is our hope that our lists will provide astrophysicists and galactic-structure astronomers with many profitable objects for further study, and we earnestly apologize in advance for any errors on our part that may cause them to lose invaluable observing time.