THE CASE LOW-DISPERSION NORTHERN SKY SURVEY

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ABSTRACT

The Burrell Schmidt-type telescope of the Warner and Swasey Observatory in its new location on Kitt Peak in Arizona is being used for a spectroscopic survey of the region $b > +30^{\circ}$. and $\delta > +30^{\circ}$. The plates, which cover $5^{\circ} \times 5^{\circ}$, are taken with the $1^{\circ}.8$ prism which provides a dispersion of 1350 Å mm^{-1} at Hγ. Eastman Kodak IIIa-J plates, baked in forming gas, are used without filter to cover the spectral range 3300 to 5350 Å. The exposure times of 75 minutes reach a limiting blue magnitude of ∿ 18.0 for threshold detection of an unwidened stellar continuum. The categories of objects which are being catalogued are blue and/or emission-line galaxies, probable HII regions, blue and/or emission-line stellar objects, known and probable blue stars, main-sequence late B and A-type stars, suspected field horizontal-branch stars of types A and F including RR Lyrae variables, suspected F and G-type subdwarfs showing a UV excess, faint carbon and late M suspected halo giants, and peculiar objects.

INTRODUCTION

When the Burrell Schmidt was moved to Kitt Peak in 1979, we began a large scale objective-prism survey of the northern sky ($\delta > +30^{\circ}$, $b > +30^{\circ}$) for a variety of galactic and extragalactic objects.

The Burrell Schmidt features a recently refigured 90 cm primary mirror, a new 61 cm corrector plate of Schott UBK7 glass a field of $5^{\circ} \times 5^{\circ}$ and a plate scale of ∿ 100" mm^{-1}. The prism used in our survey is made of Schott UK50 glass, has an apex angle of $1^{\circ}.8$, and provides a dispersion of 1350 Å/mm at Hγ. Eastman Kodak IIIa-J plates, baked in forming gas, are used without filter to provide spectral coverage from 3300 to 5350 Å. Careful guiding produces unwidened spectra just under 0.03 mm in width. Exposures of 75 minutes reach a limiting magnitude of B ∿ 18.0 for threshold detection of a continuum of a stellar object.

M. Capaccioli (ed.), Astronomy with Schmidt-Type Telescopes, 53–56.

GENERAL PROCEDURES

Each of the 19.6 cm x 19.6 cm photographic plates are scanned by both workers. Scanning is done by means of a binocular microscope or a converted aerial film scanner which projects an enlarged view of the plate onto a screen. Palomar Observatory Sky Survey prints are examined to eliminate overlaps and to aid in distinguishing between resolved and unresolved objects.

Equatorial coordinates are derived from measures of the spectra using Stephenson's analysis of the influences of the curved focal surface and the objective prism (Stephenson and Sanduleak 1977). The α measure is made by bisecting the narrow spectrum which is dispersed in the north-south direction, and has an accuracy of $\pm$3". The δ measure is made by setting on the long wavelength end of the spectrum. Since this cutoff depends on both color and brightness, the δ has an accuracy of $\pm$6". Crude estimates of m_B - to the nearest magnitude - are given to aid in identifying the objects. These are based on eye estimates of the continuum density near 4500 Å.

There have been many surveys, especially in the north galactic polar cap, for blue objects. Most of these have been multicolor rather than spectroscopic surveys. A comprehensive literature search is made to obtain additional information and previous designations of objects found in our survey. When finding charts are available, recovery of previously known objects is unambiguous. More commonly, only positions and magnitudes have been published and recovery is more difficult. In such cases, we prepare transparent overlays and search the region surrounding the published positions on our spectral plates.

DESCRIPTION OF THE CATEGORIES

A unique aspect of this survey is the wide variety of objects which are being catalogued. A list and description of our categories is as follows:

I. Blue and/or Emission-line Galaxies.

These are objects which appear nonstellar on our spectral plates and/or on the POSS prints and which have a bluer continuum than the average galaxy and/or which show emission. The emission most often seen falls near the long wavelength end of the spectrum and can be identified as the blended N_1+N_2 lines of [OIII]$\lambda\lambda$5007, 4959. Less frequently emission is seen near the short wavelength end of the spectrum; this identified with [OII]λ3727. Occasionally, an unresolved object will show both of these emission features. We consider such objects to be compact galaxies and include them in category I.

IA. Probable HII Regions.

When emission as described above is contained in knots distinct from the central or primary concentration of light in well-resolved and

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moderately bright galaxies, we consider these to be probable HII regions.

II. Blue and/or Emission-line Stellar Objects.

These are objects which are unresolved on our spectral plates and on both the E and O POSS prints. They generally show either a featureless, and relatively flat continuum extending well below the (absent) Balmer discontinuity or an emission feature or features located anywhere within the range 3300 to 5350 Å. Broad dips in the continuum are sometimes noted. Unless additional information is available, we do not attempt to identify a single emission feature, although work with the nearly identical Curtis Schmidt at CTIO (MacAlpine and Feldman 1982 and references therein) has shown that Lyα is most often the correct identification, in which case the object is a QSO with $1.7 < z < 3.3$. Until further observations are available, we do not know how many of the non-emission-line blue stellar objects are galactic stars and how many are extragalactic.

III. Known and Probable Blue Stars.

Objects in this category appear stellar on our plates and on the POSS prints. In most cases they are distinguished from category II objects by one or more of the following spectral characteristics: a) weak or broad Balmer lines, b) an incipient Balmer discontinuity, c) the continuum shortward of 3700 Å is more heavily exposed than the blue-green (4200-5350 Å) region. Also included in category III are objects with featureless flat spectra which might otherwise be put in category II except for the fact that they are known to have appreciable proper motion and thus must be galactic stars. Similarly, any blue object recovered by us which has been previously classified as a star on the basis of higher dispersion spectroscopy is placed in category III. When the Balmer lines are very broad and there is no Balmer discontinuity, the object is very likely an A-type white dwarf.

IV. Main Sequence Late B and A-type Stars.

These have spectra which exhibit a definite Balmer discontinuity and strong Balmer absorption lines.

V. Suspected Field Horizontal-branch Stars of Types A and F Including RR Lyrae Variables.

These have flat spectra with Balmer discontinuity but no apparent Balmer absorption lines.

VI. Suspected F and G-type Subdwarfs Showing a UV Excess.

Objects whose spectra have gradients in the blue-green like F and G stars but show unusually strong UV continua are placed in this category.

VII. Faint Carbon and Late M Suspected Halo Giants.

Carbon stars can be identified by the presence of the 4737 and/or 5165 C_2 bands. Late M stars are recognizable by the effects of the strong 4762, 4954 and 5167 TiO bands.

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VIII. Peculiar Objects.
Spectra with emission and/or absorption features which do not fit into any of the above categories are placed in this category.

PRESENT STATUS OF THE SURVEY

Approximately 5000 square degrees ($\sim$ 225 fields or plates) are required to cover the northern sky to $\delta > +30^{o}$, $b > +30^{o}$. Two thirds of these plates have been taken; 25 have been scanned and measured. It is our intention to publish lists of objects with finding charts as we complete small areas. Particularly interesting objects will be announced as we encounter them. First results have been published in two papers (Sanduleak and Pesch 1982, Pesch and Sanduleak 1983). The completion of the converted aerial film scanner which makes it possible to combine the scanning and measuring is expected to speed up the project.

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