

# HAMBURG OBSERVATORY NORTHERN MILKY WAY SPECTRAL SURVEY FOR EMISSION OBJECTS

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## 1. INTRODUCTION

Objective-prism spectral surveys open the possibility to search for faint emission-line objects with the aim to complete their statistics and to pick out most interesting individual objects for further study. In the years 1964 - 1970 the Hamburg  $H_{\alpha}$  Spectral Survey of the Northern Milky Way was accomplished using the Schmidt camera (80/120 cm,  $f = 240$  cm) in Bergedorf with the following parameters: area  $l\ 32^{\circ} - 214^{\circ}$ ,  $-10^{\circ} < b < +10^{\circ}$ , 160 fields, Kodak 103aE + RG 1, exp. 60 min, widen.  $10''$ ,  $4^{\circ}$  prism ( $580\ \text{\AA}/\text{mm}$  at  $H_{\alpha}$ ). As a main result the list of about 140 faint objects classified as planetary nebulae or possible planetary nebulae (Kohoutek, 1965, 1969a, 1972), and the identification of about 1500 new stars having  $H_{\alpha}$  in emission (Kohoutek, Wehmeyer, in preparation) can be reported. The best known examples of this survey are K 3-50, a prototype of a compact H II region, and the symbiotic variable HBV 475 = V 1329 Cyg (Kohoutek, 1969b), which is also classified as a protoplanetary nebula.

As the  $H_{\alpha}$ -survey is not adequate for satisfactorily classifying the emission objects we have started a new survey in two colours (SPS), which in addition covers an area of the Milky Way larger than before. The opportunity to realize this project was given after the Schmidt camera had been moved from Bergedorf to the German-Spanish Astronomical Center, Calar Alto, Spain.

## 2. AIM AND MAIN PARAMETERS OF THE SPECTRAL SURVEY

The main aim of the SPS is the investigation of faint emission objects up to 17 - 18 mag: search for new objects, and verification of the classification of the objects already catalogued:

- (1) Search for planetary nebulae and small (compact) H II regions.  
We expect to find new candidates which either lie beyond our  $H_{\alpha}$ -survey or which are very faint. The presence and the intensity of [O III] 5000, 4959 emission lines will serve as a main criterion for classification.
- (2) Search for faint WR-stars.  
The classification criteria are emission lines  $H_{\alpha}$ , He II 4686, C III 4650 or N III 4638 and NV 4609 Å.
- (3) Search for novae and variable emission stars.  
Comparison with the old  $H_{\alpha}$ -survey (1964-70). Attention will be paid to young T Tauri stars (type V 1057 Cyg), to protoplanetary nebulae (type V 1016 Cyg, HBV 475) and to symbiotic stars.
- (4) Stars having  $H_{\alpha}$  in emission.  
In this wide category all emission stars are meant which are not included in (2) and (3), especially Be and Me stars. The Catalogue of  $H_{\alpha}$  emission stars in the northern Milky Way (in preparation) will be supplemented.

In addition supplementary lists of faint stars having particular spectral types (e.g. carbon stars) will be prepared. Moreover, if necessary the new plate material will enable a rough spectral classification of stars up to about 17 mag, and it may serve for later comparison.

#### SURVEY PARAMETERS:

$12^{\circ} - 234^{\circ}$ ,  $-15^{\circ} < b < +15^{\circ}$ , 330 fields ( $5.5^{\circ} \times 5.5^{\circ}$ )  
4 $^{\circ}$ -prism (580 Å/mm at  $H_{\beta}$ )

#### Red region:

103aE + RG 610 (6100 - 6700 Å), exp. 15 min, widen. 10"

#### Blue region:

IIaO + GG 455 (4550 - 5150 Å), exp. 75 min, widen. 5"

For the red region we have chosen this plate + filter combination in order to have possibility to compare directly the present survey with the  $H_{\alpha}$ -survey from 1964-70. The red plates are short exposed but later on we intend to extend this material by very deep plates (IIIaF emulsion).

In the blue region the range 4550 - 5150 Å can be considered as most interesting for emission objects; we have realized it using Kodak IIaO plates and Schott GG 455 filter. In order to reach the stellar limiting magnitude of at least 17 mag, and to avoid the overlapping of the spectra, it was not possible to extend this narrow spectral range (and to use the IIIaJ emulsion).

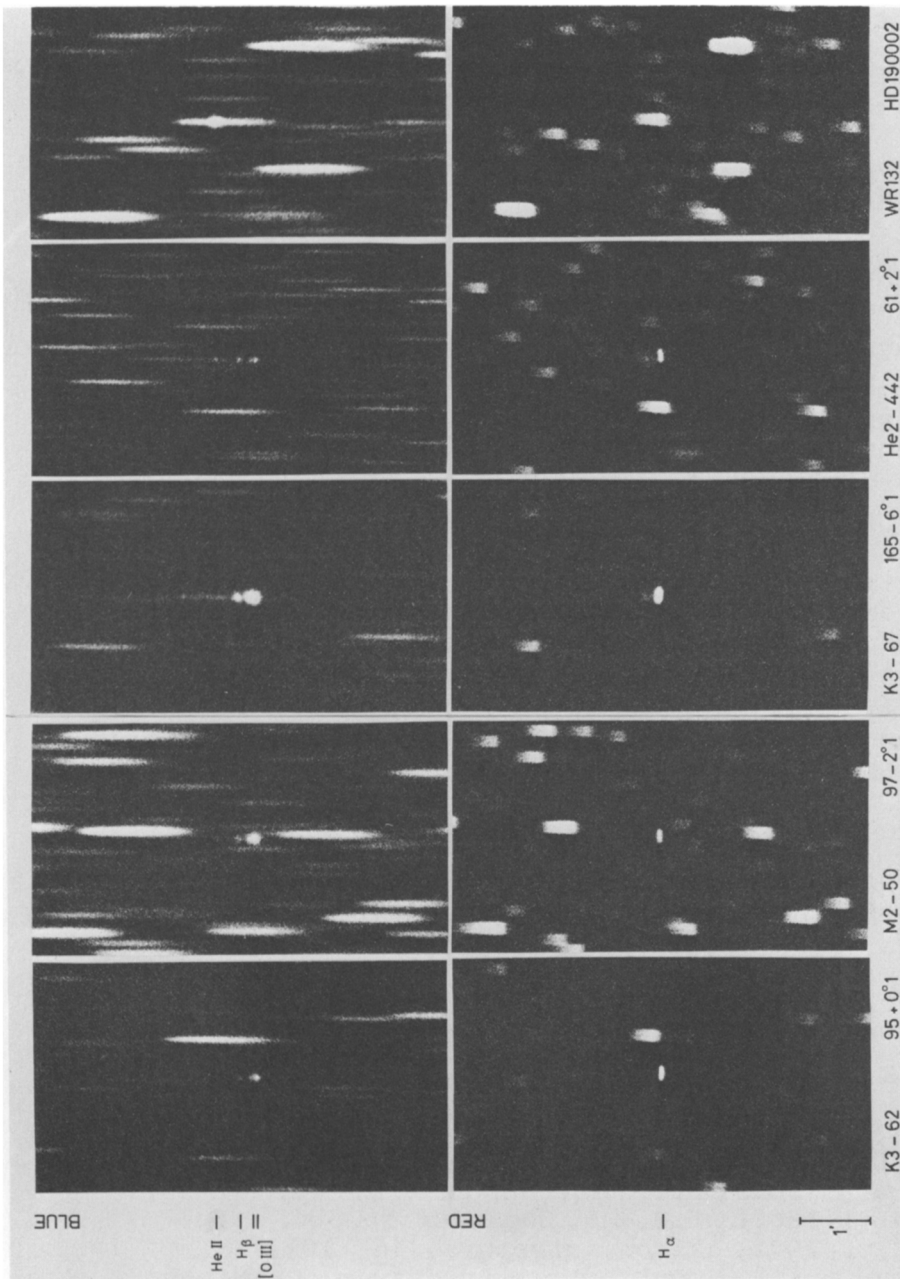


Figure 1 Examples of some individual objects seen on survey plates.

### 3. PRESENT STATUS OF THE SPECTRAL SURVEY AND EXAMPLES

We started the SPS in the year 1981, and till now (August 1983) plates of about 50 fields have been taken. At present the visual inspection of the material is in progress; the possibility to analyse our plates automatically would of course be supported in case this reduction technique would turn out to be effective enough.

In this contribution examples are given showing how some individual objects appear on the red and blue survey plates:

K 3-62 (95+0<sup>0</sup>1): stellar planetary nebula showing bright lines of H $\alpha$ , [O III] 5007, 4959 > H $\beta$  and no continuum.

M 2-50 (97-2<sup>0</sup>1): small planetary (~4") having extremely bright [O III] 5007, 4959 lines.

K 3-67 (165-6<sup>0</sup>1): stellar planetary with H $\alpha$  and [O III] 5007, 4959 > H $\beta$ ; a trace of H $\gamma$  and a faint continuum is visible.

He 2-442 (61+2<sup>0</sup>1): probably stellar planetary having the lines [O III] 5007, 4959 comparable with H $\beta$  and a bright He II 4686 line. Allen (1974) described it as "compact PN with circumstellar dust emission (class D)". This object should be investigated in more detail because both the low and high excitation characteristics are present.

WR 132 (HD 190002). The emission features (H $\alpha$ , C III, IV 4650, He II 4686) of this WC 6 Wolf-Rayet star of  $v = 11.55$ ,  $b - v = +1.13$  (see van der Hucht, et.al., 1981) are overexposed, the continuum is strong.

We intend to publish the results of the SPS in numerous contributions which will contain single lists of objects of various categories. The present part of the Spectral Survey is financially supported by Deutsche Forschungsgemeinschaft.

### REFERENCES

- Allen, D.A., 1974, Monthly Notices Roy. Astron. Soc. 168, 1.  
 Kohoutek, L., 1965, Bull. Astron. Inst. Czech. 16, 221.  
 Kohoutek, L., 1969a, Bull. Astron. Inst. Czech. 20, 307.  
 Kohoutek, L., 1969b, I.B.V.S. Budapest No.384.  
 Kohoutek, L., 1972, Astron. Astrophys. 16, 291.  
 van der Hucht, K.A., Conti, P.S., Lundström, I., Stenholm, B., 1981, Space Sci. Rev. 28, 227.