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A Study of Diffuse Southern Hα Nebulae.

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Supervisor's Statement.

When Mr. Gum was taken ill in July, 1953, he had completed a draft of his paper and discussed it with me. This draft is reproduced here, with the following alterations:

(i) a discussion at the beginning of section 6 has been condensed into the second paragraph of that section.

(ii) the first paragraph in section 7 is new. Both these changes had been agreed to by Gum.

(iii) Gum's figure 3 has been withdrawn. Many points in his figure did not agree with the data in table I, and for some I could find no authority at all. The present figure 3 reproduces the data of Table I.

The discrepancies between the data of Table I and the notes on individual nebulae in section 6 I have let stand. A note should be added on object 38b, which Costerhoff found to be very heavily reddened, the total absorption of the central star being greater than 1.1 magnitudes.

(iv) Figure 4 is partly and figure 5 entirely new. The lower half of figure 7 is missing. In the upper half I thought that the galactic equator is horizontal, instead of vertical as in the other plate.

(v) Most of the references have had to be located and may not always be correct. There are still some gaps. A very relevant paper has since appeared by H.P. Weaver, A.J. 58, 177, 1953, which anticipates some of Gum's findings on the inner arm.

This work was done under my formal supervision. Gum, however, worked largely independently, and all the leading ideas were definitely his own. This applies in particular to the superposition method, and to the ideas on galactic structure developed in section 7. It should also be mentioned that the equipment was extensively damaged in the fire of February 1951, and it was due to Gum's largely unaided efforts that it was put into operation again.

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A Study of Diffuse Southern Nebulae.

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Summary.

The results of a photographic survey for diffuse Hα emission nebulosities (HII regions) in the Southern Milky Way from galactic longitude l = 190° to 350° are given. A catalogue, which includes a number of new objects, lists positions and dimensions of 85 physically separate HII regions together with details of the exciting stars and their distance moduli when available.

The faintest objects detected have $n_3 = 1$, where $n_3$ is the number of third level hydrogen atoms in a column 1 cm$^2$ in cross-section passing through the nebula in the direction of the line of sight.

A scheme of classification describing the large-scale structural features of HII regions is suggested. The main criterion is the radial variation of surface brightness within the nebula. Most HII regions may then be arranged in an almost continuous sequence from those having a very high central surface brightness, ($n_3$ up to 200), which decreased with increasing distance from the centre, (Class I), to fainter objects ($n_3 \sim 5$) in which most of the emission is concentrated in a ring or in an incomplete ring (Class IV). One of the intermediate classes (Class III) has a practically uniform surface brightness over a circular disk with the exciting star at the geometrical centre. This class corresponds most closely to Stromgren's idealised HII regions, which then appear as a special case in a more general sequence of structural forms. The classification is also applicable to emission nebulosities in other stellar systems where only large-scale features may be observed.
The statistical relation between the apparent photographic magnitude of the exciting star and the apparent diameter of the nebulosity is discussed and compared with Hubble's original relation derived from blue-sensitive plate material.

The spatial distribution of the Southern HII regions can be studied in only a tentative fashion at present. The results suggest certain details of spiral structure in the galaxy.