ON THE NATURE OF R 136, THE CENTRAL OBJECT OF 30 DOR. A COMPARISON WITH THE GALACTIC CLUSTER NGC 3603.

Michael Rosa [1], Jorge Melnick [1 2], Preben Grosbol [1]
1 European Southern Observatory, Garching/Munich, FRG
2 Universidad de Chile, Santiago, Chile

ABSTRACT

The massive H II region NGC 3603 is the closest galactic counterpart to the giant LMC nebula 30 Dor. Walborn (1973) first compared the ionizing OB/WR clusters of the two H II regions and suggested that R 136, the unresolved luminous WR + O type central object of 30 Dor, might be a multiple system like the core region of NGC 3603. Suggestions that the dominant component of R 136, i.e. R 136A, might be either a single or a very few supermassive and superluminous stars (Schmidt-Kaler and Feitzinger 1982, Savage et al. 1983) have recently been disputed by Moffat and Seggewiss (1983) and Melnick (1983), who have presented spectroscopic and photometric evidence to support the hypothesis of an unresolved cluster of stars. We have extended Walborn's original comparison of the apparent morphology of the two clusters by digital treatment of the images to simulate how the galactic cluster would look like if it were located in the LMC

Electronographs of the H II regions were secured in the same night with the 40 mm McMullan camera at the Danish 1.5m telescope at La Silla (Melnick and Grosbol 1981). The V band films have a seeing of 1.8 arcsec FWHM and were digitized with a resolution of 0.2 arcsec. We have adopted a distance ratio of 7 between the 30 Dor complex (52 kpc) and NGC 3603 (7 kpc). To reproduce the dimming of NGC 3603 when moved away to the LMC we have corrected the film densities by the ratio in exposure times and additional factors of 1/49 due to the increase in distance and 14 due to the different foreground extinction, 4.5 mag to NGC 3603 and about 1.7 mag to R 136 in 30 Dor. The "moved" image of NGC 3603 has been convolved with a seeing of 1.8 arcsec and artificial noise with a gaussian distribution similar to that in the background of the 30 Dor image has been added to make the "observations" comparable.

Here we have to limit our presentation to the contour plots produced from the final images. We note however that the apparent similarities in the morphology of the two clusters, as seen at the same scale on the sky, are striking (see figures in Walborn 1973) but misleading. In fact, the image of NGC 3603 (3 arcmin overall diameter) as seen at the distance of the LMC (Fig.1) covers only the innermost 25 arcsec of 30 Dor (Fig.2). The blurred

S. van den Bergh and K. S. de Boer (eds.), Structure and Evolution of the Magellanic Clouds, 257–258.

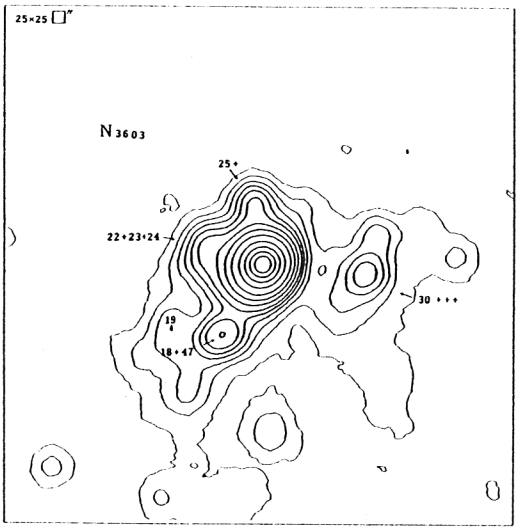

Fig.1 NGC 3603 at the LMC distance

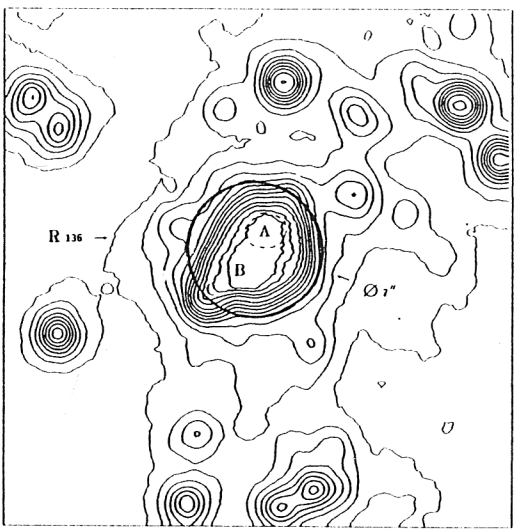

Fig.2 The vicinity of R 136

image of the whole NGC 3603 cluster is very similar to R 136 and its nearby environment. The merging of the individual stellar images in NGC 3603 into unresolved stellar like blobs at the distance of the LMC is indicated in Fig. 1 by identification of the dominant objects. The compact source R 136A seems to be comparable to the unresolved core of a populous bright cluster. This conclusion is even more enforced by the analysis of the central part of NGC 3603 that is going to make up the unresolved bright stellar like peak in Fig. 1. Within an area of 1.5 arcsec in diameter (10" at galactic distance) are located 10 to 20 stars of types O5 and earlier, including at least one WN 6 (Moffat 1983). The quantitative comparison of this cluster of O stars in NGC 3603 with R 136A has been presented in detail by Moffat and Seggewiss (1983). The intriguing result is an absolute V magnitude of -9.3 for NGC 3603 as compared to -8.3 for R 136A within 1.5 arcsec.

With our *a priori* knowledge of the "true" nature of NGC 3603 we have to support the earlier conclusions that R 136 is the almost unresolved core of a dense cluster, consisting of dozens of very massive but normal O and WR stars, and that its components, namely R 136A, are still unresolved groups of theoretically wellknown objects below the 140 $M_{\odot}$ threshold.

REFERENCES

Melnick,J.,Grosbol,P.: 1981, Astron.Astrophys. 107, p 23
Melnick,J.: 1983, The Messenger, No 32, p 11
Moffat,A.F.J.: 1983, Astron.Astrophys. 124, p 273
Moffat,A.F.J.,Seggewiss,P.: 1983, Astron.Astrophys. 125, p 83
Savage,B.D.,Fitzpatrick,E.L.,Mathis,J.S.,Ebbets,D.C.: 1983, Ap J, in press
Schmidt-Kaler,Th.,Feitzinger,J.V.: 1982, in "The Most Massive Stars", Proc. of ESO Workshop, S.D'Odorico,D.Baade,K.Kjaer (eds), p 105
Walborn,N.R.: 1973, Ap J Lett. 182, p L21

https://doi.org/10.1017/S0074180900040341 Published online by Cambridge University Press