

The Massive Star Content of NGC 3603

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We investigate the massive star content of NGC 3603, the closest known giant H II region. We have obtained spectra of 26 stars in the central cluster using the Baade 6.5-m telescope (Magellan I). Of these 26 stars, 16 had no previous spectroscopy. We also obtained photometry of all of the stars with previous or new spectroscopy, primarily using archival HST ACS/HRC images. The total number of stars that have been spectroscopically classified in NGC 3603 now stands at 38. The sample is dominated by very early O type stars (O3); there are also several (previously identified) H-rich WN+abs stars. We derive $E(B-V)=1.39$, and find that there is very little variation in reddening across the cluster core, in agreement with previous studies. Our spectroscopic parallax is consistent with the kinematic distance only if the ratio of total to selective extinction is anomalously high within the cluster, as argued by Pandey et al. Adopting their reddening, we derive a distance of 7.6 kpc. We discuss the various distance estimates to the cluster, and note that although there has been a wide range of values in the recent literature (6.3-10.1 kpc) there is actually good agreement with the apparent distance modulus of the cluster---the disagreement has been the result of the uncertain reddening correction. We construct our H-R diagram using the apparent distance modulus with a correction for the slight difference in differential reddening from star to star. The resulting H-R diagram reveals that the most massive stars are highly coeval, with an age of 1-2 Myr, and of very high masses (120 Mo). The three stars with Wolf-Rayet features are the most luminous and massive, and are coeval with the non-WRs, in accord with what was found in the R136 cluster. There may be a larger age spread (1-4-Myr) for the lower mass objects (20-40Mo). Two supergiants (an OC9.7 I and the B1 I star Sher 25) both have an age of about 4 Myr. We compare the stellar content of this cluster to that of R136, finding that the number of very high luminosity ($M_{bol} < -10$) stars is only about 1.1-2.4x smaller in NGC 3603. The most luminous members in both clusters are H-rich WN+abs stars, basically "Of stars on steroids", relatively unevolved stars whose high luminosities results in high mass loss rates, and hence spectra that mimic that of evolved WNs. To derive an initial mass function for the massive stars in NGC 3603 requires considerably more spectroscopy; we estimate from a color-magnitude diagram that less than a third of the stars with masses above 20Mo have spectral types known.

Reference: AJ, in press

Status: Manuscript has been accepted

Weblink: <http://www.lowell.edu/users/massey/n3603final.pdf>

Comments:

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