The Initial Mass Function and Stellar Content of NGC 3603

Hwankyung Sung[1], M. S. Bessell[2]

[1]*Department of Astronomy and Space Science, Sejong University*
[2]*RSAA, Australian National University, Australia*

We present *UBVRI* and Hα photometry of the extremely compact, starburst cluster NGC 3603. Ground-based images, Hubble Space Telescope (HST) Archival data, as well as Chandra X-ray data has been used for this study. We present for the first time, optical color-magnitude diagrams (CMDs) for the stars in the cluster core down to $V = 22$ mag. A well defined main sequence as well as low-mass pre-main sequence stars can clearly be seen in the CMDs. This result confirms the finding by Einsenhauser et al. (1998) that low-mass stars are forming in the starburst cluster. We also derive an age (1 ± 1 Myr) and distance of the cluster ($V_0 - M_v = 14.2 \pm 0.2$ mag, i.e. $d = 6.9 \pm 0.6$ kpc). The interstellar reddening shows a minimum value ($E(B-V) = 1.25$ mag) at the core ($r \leq 0.''2$) and increases rapidly up to $E(B-V) \approx 1.8$ mag (or even higher) with increasing distance from the center, which suggests the presence of a wind-driven cavity near the cluster center (Frogel et al. 1977; Claton 1986). We also determine the radius of the cluster ($r \approx 2'$) from the surface density profile of bright stars and X-ray sources.

To investigate the initial mass function (IMF) of the cluster, we performed a completeness test for the core region. Using the theoretical mass-luminosity relation of MS stars, we derived the IMF of stars imaged with the HST/PC1. The surface density of stars in the core is enormously high and decreases gradually with increasing distance from the center. The slope of the IMF also shows radial variation - fairly flat in the core ($\Gamma = -0.5 \pm 0.1$ at $r \leq 0.''1$) and gradually steepening ($\Gamma = -0.8 \pm 0.2$ at $r = 0.''1 \sim 0.''2$ and $\Gamma = -1.2 \pm 0.2$ at $r > 0.''2$ of HST/PC1). The stars in the halo region of NGC 3603 (outside of HST/PC1) seem to be slightly older (age ≈ 5 Myr) and presumably have formed before the stars in the core.