The Initial Mass Spectrum of NGC 602

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Abstract

The Large and Small Magellanic Cloud (LMC, SMC), our closest undisrupted neighboring dwarf galaxies, offer us a more or less undisturbed view of young stellar associations. They are both close enough to resolve even low mass stars of masses well below 1 $M_\odot$. But they are also far enough away so that the distance spread inside such associations is insignificant.

A variety of bright HII regions show that there is still a lot of star formation going on in the clouds. Strong winds from high mass stars as well as supernova explosions trigger star formation in their surroundings. Investigations on the Initial Mass Spectrum (IMS) of young clusters show us the influence of the massive stars on their low mass companions.

NGC 602/N 90

NGC 602, also known as the HII region N 90, was observed with the Advanced Camera for Surveys aboard the Hubble Space Telescope finding a huge number of previously undetected Pre-Main Sequence (PMS) stars. Recent investigations showed a large number of YSOs in the surroundings of NGC 602 which indicates sequential star formation processes [1].

We want to present a short overview of the locations of the most massive stars in the system (Fig. 3) and the recently obtained IMS (Fig. 1).

The general trend of the IMS we obtained by using the Siess isochrone model [2] follows a Salpeter-power-law ($\alpha = -2.35$, [5]). We get a slope of $\alpha = 2.4 \pm 0.2$ (red line, Fig. 1) for the mass range from 1−40$M_\odot$. In the intermediate mass regime we find some small deviations from this slope which we believe to be due to the peculiarities that arise as long as stars are still in their PMS phase. A multi-power-law model gives these values (blue line, Fig. 1):

$$\alpha = \begin{cases} -1.8 \pm 0.5 & \text{for } 1.1 \leq M/\mathrm{M}_\odot < 2.5 \\ -4.8 \pm 2.3 & \text{for } 2.5 \leq M/\mathrm{M}_\odot < 3.8 \\ -2.1 \pm 0.4 & \text{for } 3.8 \leq M/\mathrm{M}_\odot < 45 \end{cases}$$

The use of the Palla & Stahler isochrone model [3] yields slightly different results but the general appearance remains the same.

Initial Mass Spectrum

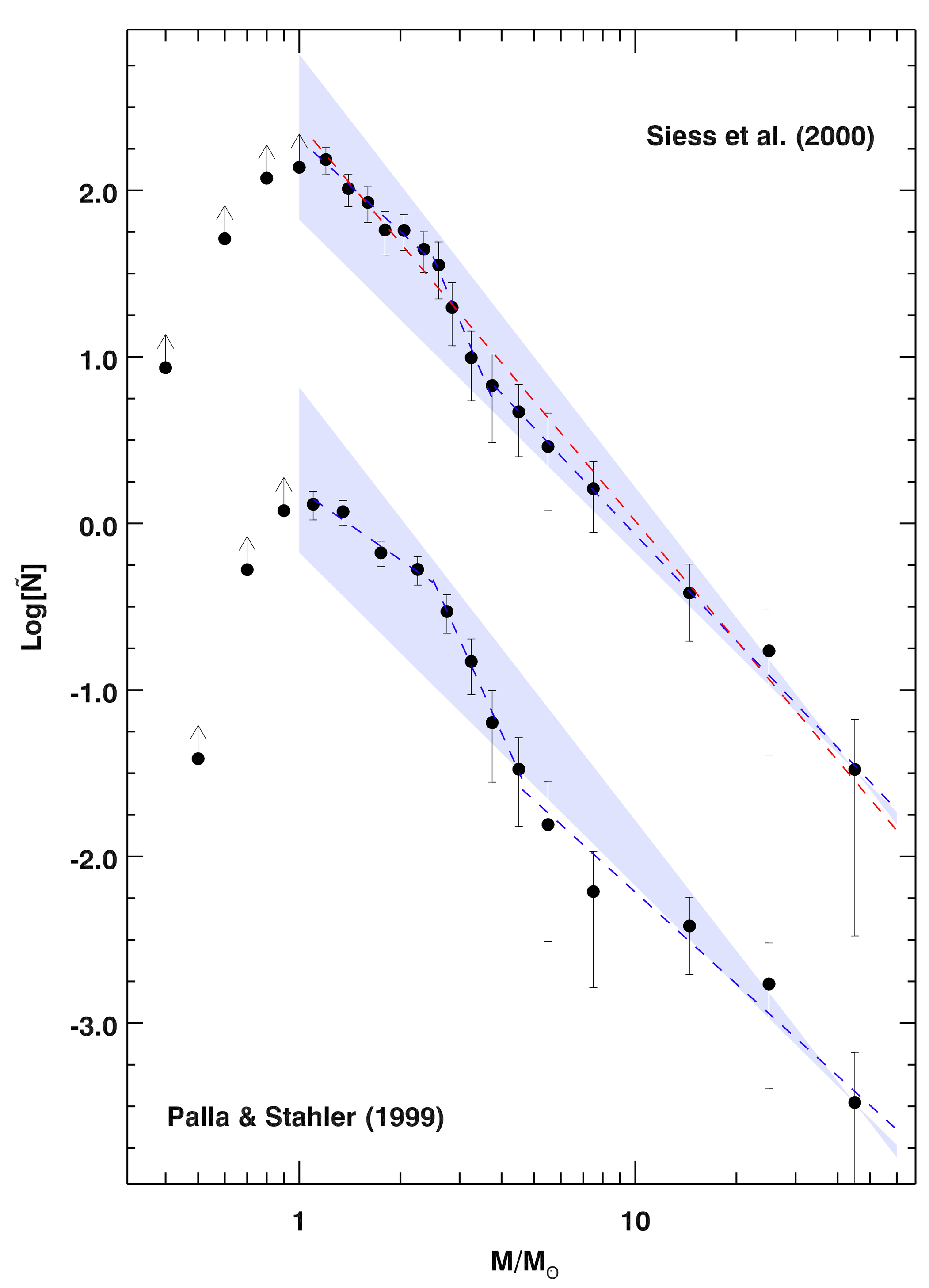

Figure 1: *The Initial Mass Spectrum (IMS) of the central cluster region (Fig. 2) obtained by counting stars between evolutionary tracks. We used two different PMS isochrone models (Siess et al. 2000 [2], and Palla & Stahler 1999 [3]). The number $\tilde{N}$ represents the number of stars normalised to a binsize of 1 $M_\odot$ and corrected for incompleteness. In this plot we only included stars with a completeness of at least 50%. The Hubble ACS observations give us reasonable results for masses down to roughly 1 $M_\odot$. The blue-shaded regions show the Kroupa-IMS model [4] with a slope of $\alpha = -2.3 \pm 0.3$.*

NGC 602/N 90

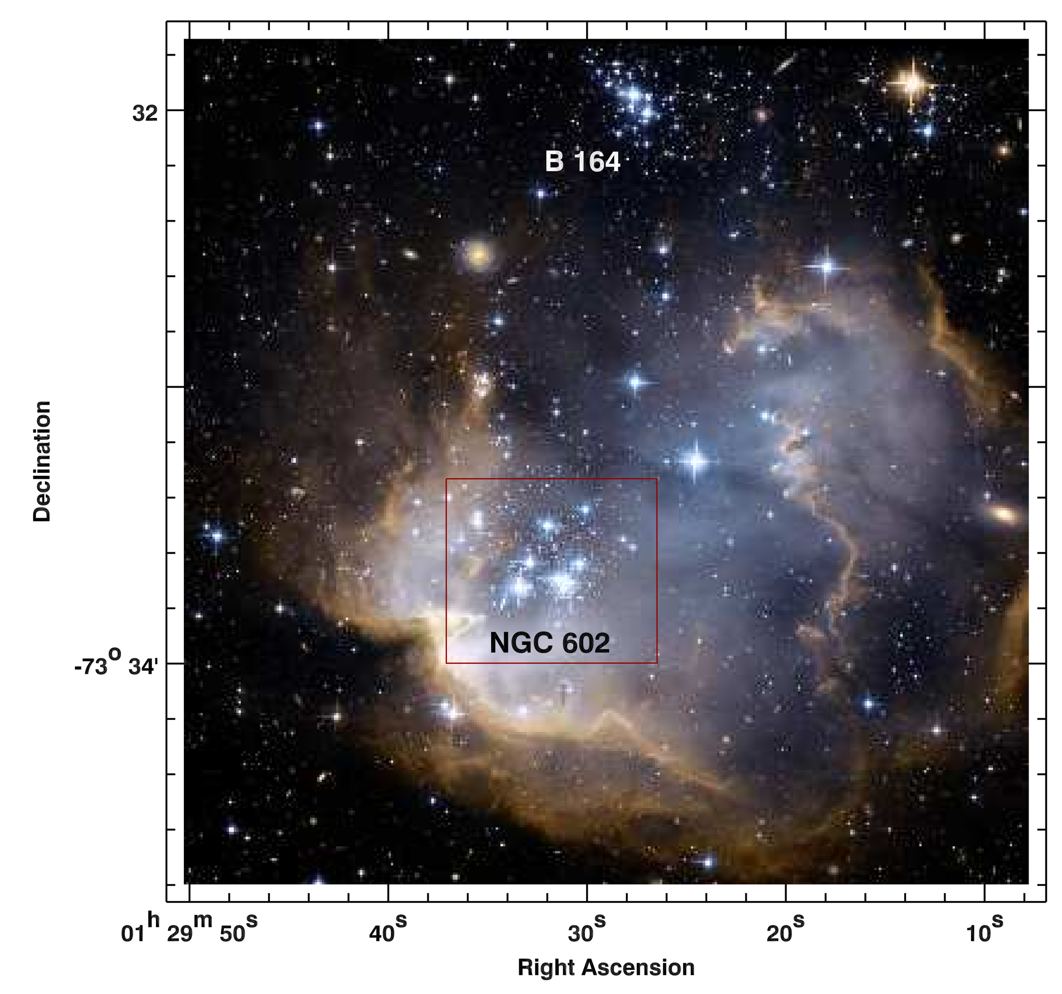

Figure 2: *Colour-composite image of the star forming region NGC 602 from the two broadband filters $F555W$ and $F814W$ (Johnson V and I band) as well as the Hα narrowband filter $F658N$. The central cluster region of NGC 602 is defined by the red box. It encompasses the 3σ isopleth of the PMS density plot (blue contours in Fig. 3). Also marked is a nearby small cluster with just Main Sequence stars (B 164) and its heaviest member with roughly 5 $M_\odot$.*

Brightest UMS stars vs. PMS stars

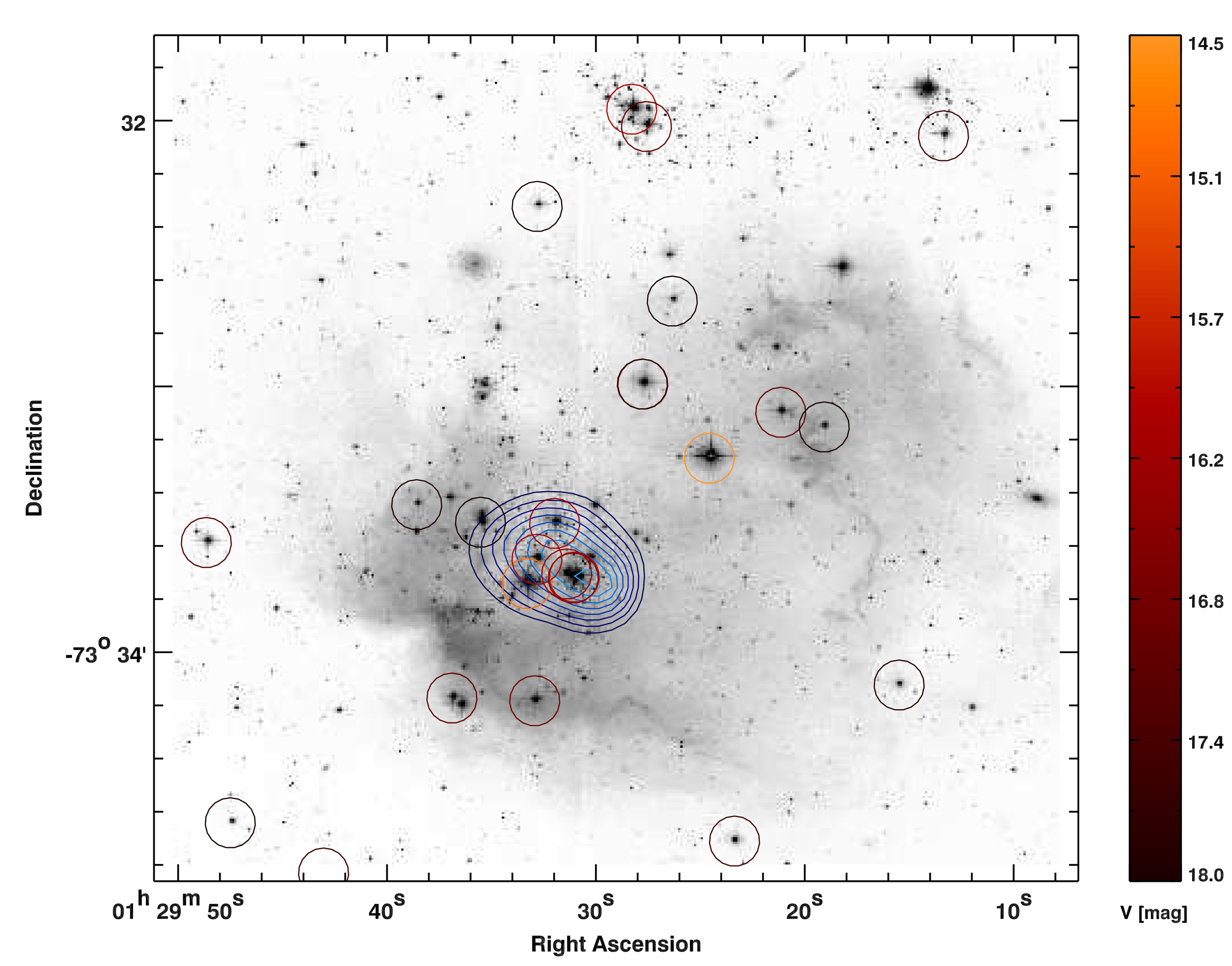

Figure 3: *The position of the 25 brightest UMS stars (circles) in comparison to the locus of the PMS stars (blue contours). The first isopleth of the contour plot refers to the 3σ line of the PMS star distribution. A strong concentration towards the central region of the cluster is visible with a maximum deviation of 10σ from the mean PMS density. The colour of the circles indicates the stellar V-brightness according to the colourbar. Five out of the seven most luminous stars belong to the association. The other brighter members are mainly embedded in the nebulosity where some appear directly inside the surrounding ribbonlike structures. These stars are good indicators for progressive star formation triggered by the central stars [1].*

References

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