counterparts of the excess faint galaxies if the latter are assumed to have a typical redshift of $z = 0.25$ at $B \approx 24$ (as in Cowie *et al*, 1991), though their magnitudes are consistent.

The angular two-point correlation function has been measured for a field of faint galaxies to $\upsilon \approx 26.5$ at the South Galactic Pole. The clustering of these faint galaxies is shown to be as low as that found by Efstathiou *et al.* (1991), but Neuschaefer *et al.*'s (1991) rising correlation function amplitudes as a function of median sample magnitude are not found. The former implies that clustering growth is faster than it would be if clustering were fixed in proper coordinates, i.e., $\varepsilon > O$ (eqn (4.25)). If for some reason we have over estimated the uncertainties in our measurements, this result would be even stronger. Efstathiou *et al.* feel that $\varepsilon > O$ is unlikely, so their favoured explanation is that the weakness in clustering is due to the excess faint galaxies being an intrinsically faint, low redshift, more weakly clustered than normal population. N-body models used in this thesis do in fact predict $\varepsilon > O$ in agreement with Efstathiou *et al.* (§6.4), but they also have a spatial correlation function amplitude which is far lower than cosmological amplitudes, so this does not seriously overrule the N-body results of Melott (1992) or Yoshii *et al.* (1993) or the observational data of Warren *et al.* (1993), which all indicate that $\varepsilon > O$. Instead, it provides a constraint with which to check future N-body simulations which are normalised with the intention of having correlation functions at a cosmological scale.

Merger-induced evolutionary population synthesis (MIEPS) models are defined and results shown in Chapters 5 and 6. Apart from two caveats on spatial correlation function normalisation and the size of the time interval between time stages used, these models look like a good candidate for explaining the faint counts, as expected. Burst-only star formation rate models are found to be necessary, as exponentially decaying star formation rates do not flatten the faint end of the mass function enough in converting it into a luminosity function. The burst-only models with initial perturbation spectra as power law spectra with indices of $n = 0$ and $n = -2$ and detection thresholds of $r_{\rm thresh} = 5$ and $r_{\rm thresh} = 1000$ were run. The model with the most expected parameters ($n = -2$, $r_{\rm thresh} = 1000$) gives a luminosity function which roughly fits a Schechter function at $t \approx t_o$, but gives number counts which clearly don't fit the observations; while a model with less likely parameters ($n = 0$, $r_{\rm thresh} = 5$) gives a luminosity function which has the slope of a Schechter function and fits a Schechter function overall if the compensatory factor A is allowed, in which case the number counts fit reasonably well to the observations apart from the faint end. An increase in time resolution of the N-body output is likely to improve the fit of the latter model more than that of the former.

Hence, these models favour a white-noise-like initial perturbation spectrum ($n \approx 0$) with a low detection threshold ($r_{\rm thresh} \approx 5$) and a correction factor $A = 7$ as a candidate for explaining the excess of faint galaxies; while a CDM-like spectrum on these scales ($n \approx -2$) appears less likely.

An additional result from the N-body galaxy evolutionary modelling is that the individual merger rates can be very different from the average merger rates and that the fraction of mass coming from accretion can be quite high. for example, for the $n = 0$, $r_{\rm thresh} = 5$ model, the mean number of peaks which collapse from the intergalactic medium at any time stage and end up in a peak at the final time stage is 7.4, while the standard deviation in this quantity is 20.7. While this result is likely to quantitatively change with the new N-body simulations, qualitatively it is unlikely to.

THE NATURE OF STAR FORMATION IN THE TRAPEZIUM CLUSTER

Angela E. Samuel

Mount Stromlo and Siding Spring Observatories, Australian National University, Canberra ACT 2601

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The Trapezium Cluster stellar population is studied in detail using near-infrared and optical means in order to probe the clustered mode of low and high mass star formation. We determine fundamental stellar parameters such as the spectral types, ages, masses, extinctions and dust excesses for a significant number of cluster stars. Various techniques are applied to deredden the stars in the colour-magnitude diagram and hence compare intrinsic positions with theoretical evolutionary tracks. Through these means, we estimate properties of the low mass stellar population to greater accuracy than has previously been achieved.

Near-infrared photometry of Trapezium Cluster stars provides an initial evaluation of the nature of the cluster population. This evaluation is improved upon using optical spectroscopy to measure spectral types of a large number of Trapezium Cluster stars for the first time. We find our sample of Trapezium Cluster stars to have a mean spectral type of mid-K, in agreement with findings for the low mass stars in the vicinity of, and external to, the central cluster. The stars are dereddened on the colour-magnitude diagram using our acquired spectral types. Their intrinsic positions provide the most accurate determination for the cluster age obtained to date, $\sim 10^6$ yr, confirming the pre-main sequence nature of the population. This age estimate is extended to the infrared cluster population of more than 550 stars revealed by infrared-array images K luminosity function for the infrared cluster is used in combination with the cluster age to derive the stellar mass distribution. The slope of the mass function obtained here is found to be comparable with the slopes of field initial mass functions. A mean stellar mass of $\sim 0.9\ M_\odot$ is estimated for the low mass stars. Our determinations for the masses, ages, and spectral types of Trapezium Cluster stars shows that they are a similar stellar population to the more extended Orion Nebula Cluster population, except in density of stars. The mass density of the Trapezium system of low mass and high mass (Θ^1 Ori) stars is found to be $\sim 4690\ M_\odot\ {\rm pc}^{-3}$, approximately 1.5 times greater than previous estimates based on optical studies. The stellar mass derived for the low mass cluster is also used to calculate the star formation efficiency in the region to first order, ~ 72%. This is similar to, but higher than, the star formation efficiencies determined in other regions of embedded cluster formation.

The mean extinction estimated for the low mass cluster stars in our sample place the stars at approximately the same depth into the molecular cloud as the Trapezium OB stars, at the near-face of the cloud. Our sample is biased towards optical members of the cluster, suggesting that a significant number of the low mass stars may be embedded more deeply in the molecular cloud than the OB stars. However, using the K luminosity function for the infrared cluster we determine that the low mass cluster is most probably not spread

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