# ESTIMATING THE LOW-MASS IMF IN OB ASSOCIATIONS: $\sigma$ ORI

Ben Burningham[1], Tim Naylor[1], S. P. Littlefair[1], R. D. Jeffries[2]
[1] *School of Physics, University of Exeter, Stocker Road, Exeter, EX4 4QL, UK*
[2] *Dept. of Physics, Keele University, Keele, Staffordshire, ST5 5BG, UK*
bgb@astro.ex.ac.uk

**Abstract** We investigate the issues of contamination and exclusion in photometric membership selection techniques when applied to OB associations. We use radial velocities to calculate membership probabilities for a sample of very low-mass candidate members of the $\sigma$ Orionis young group. We find that significant numbers of bona members are not excluded by photometric selection techniques, and for I brighter than 17 there is not significant contamination in the expected PMS region.

## 1. Introduction

The high and variable extinction found along sightlines toward the youngest clusters gives rise to large uncertainties in deriving masses and ages for low-mass members. Whilst this can be avoided by looking at low extinction regions, reliably assessing membership without the background blocking effect of a molecular cloud can bring its own issues. Here we investigate the use of radial velocity, measured from high resolution spectra of the 8183, 8195 Å Na I doublet, as a membership discriminator in the $\sigma$ Ori young group. We have selected candidates from a broad region of colour-magnitude space (see figure 1), to investigate if an appreciable number of bona fide members would be neglected as part of a tight photometric selection on a RI colour-magnitude diagram (CMD).

## 2. Radial Velocities and Membership

Sufficient signal-to-noise was attained to detect NaI with an EW = 3Å at a significance of $2\sigma$ for all 54 objects in our sample. We chose this EW as our guide as most brown dwarfs detected by Martin et al. (2004) in the Upper Scorpius OB association displayed an EW(NaI) above this

value. We detected NaI above this significance threshold in the spectra of 38 of our targets. We have calculated upper limits for EW(NaI) for most of the failed detections. We find that find that these, and the values for EW(NaI) measured for the good detections are consistent with low-mass members of $\sigma$ Ori displaying weaker EW(NaI) than were measured by Martin et al. (2004) for Upper Scorpius. It is not clear why this should be so, and this is discussed further in Burningham et al. (2004). We cross correlated the spectra with detected NaI against that of a velocity standard to obtain radial velocities. These velocities were then used to calculate probabilities of objects being radial velocity members of the $\sigma$ Ori young group, $P_{vel}$. This process is described in detail in Burningham et al. (2004). We have plotted the positions of likely members and non-members on an RI CMD (see Figure 1) in order to assess the issues of contamination and exclusion.

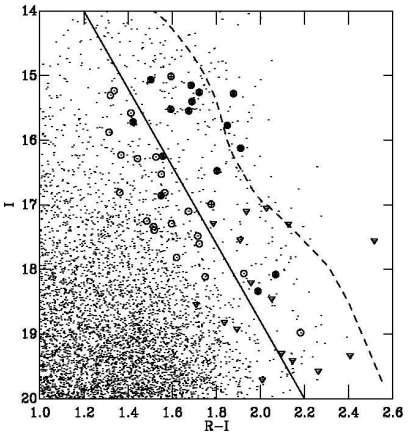


*Figure 1.* The CMD of 4 WFC fields centered on $\sigma$ Ori (catalogue taken from Kenyon et al. (2004)). Objects with detected NaI are open circles. Objects with $P_{vel} > 80\%$ are circles filled with asterisks, whilst circles filled with crosses are objects with $P_{vel} > 60\%$. Objects for with no detected NaI are open triangles. The dotted line is a NextGen 5 Myr isochrone (Chabrier & Baraffe (1997), Baraffe et al. (2002)). Our expected PMS region is defined as redward of the solid line.

## 3. Conclusions

Inspection of Figure 1 allows us to draw the following conclusions. 1) Photometric selection techniques do not miss significant numbers of bona fide association members. 2) At I brighter than 17 the expected PMS region of the CMD does not contain a significant number of contaminants.

## References

Kenyon et al. 2004, in preparation.
Baraffe et al. 2002, A&A, 382, 563
Chabrier, G. & Baraffe, I. 1997, A&A, 327, 1039
Martín et al. 2004, AJ, 127, 449
Burningham et al. 2004, MNRAS submitted.