THE IMF AND DISK ACCRETION IN THE 25 ORIONIS CLUSTER DOWN TO PLANETARY MASSES

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We present the latest results of our ongoing photometric and spectroscopic survey of brown dwarfs (BD) in the ~7 Myr old 25 Orionis group down to M~0.01$M_\odot$. The survey combines optic spectra obtained with the OSIRIS spectrograph at GTC, together with optic photometry from the CIDA Deep Survey of Orion (CDSO), IR photometry from VISTA, WISE and Spitzer+IRAC. These observations allowed us to selected a sample of VLMS and BD candidates and to detect and characterize new BD members with masses within 0.01<M/$M_\odot$<0.04. We discuss these samples of BDs in terms of the substellar system-IMF which **suggests a number of BDs lower than the expectations for an universal system-IMF**, and in terms of the fraction of objects showing IR excesses and accretion signatures which results to be 60±15% of the new BD, **supporting the idea that BD disks may not dissipate until after ~10 Myr**.

I. THE EARLY EVOLUTION OF BD AND THE 25ORI GROUP

The 25 Orionis group (Briceño et. al. 2005, 2007, Downes et al. 2013a in prep) is the most numerous and spatially dense ~7 Myr old population yet known within ~500 pc from the Sun. Given its modest angular extent and beeing almost free of extinction, it is the ideal place to study slightly evolved young VLMS and BD.

II. PHOTOMETRIC CANDIDATES AND NEW MEMBERS

We selected 1053 photometric candidates (0.01<M/$M_\odot$<0.5, complete down to 0.03$M_\odot$) in the 25 Orionis group according to their position in the I vs I-J, I vs I-H and I vs I-K color-magnitude diagrams (Figure 1) using photometry from CDSO (Downes et al. 2013a in prep.) and VISTA (Petr-Gotzens et al. 2011). We obtained the spectra of 7 BD candidates (0.01<M/$M_\odot$<0.06) with OSIRIS at GTC and confirmed 5 BDs as new members (Figure 1) on the based on their Hα equivalent widths and NaI in absorption, consistent with the expected surface gravity for young BDs (Luhman et al. 2003).

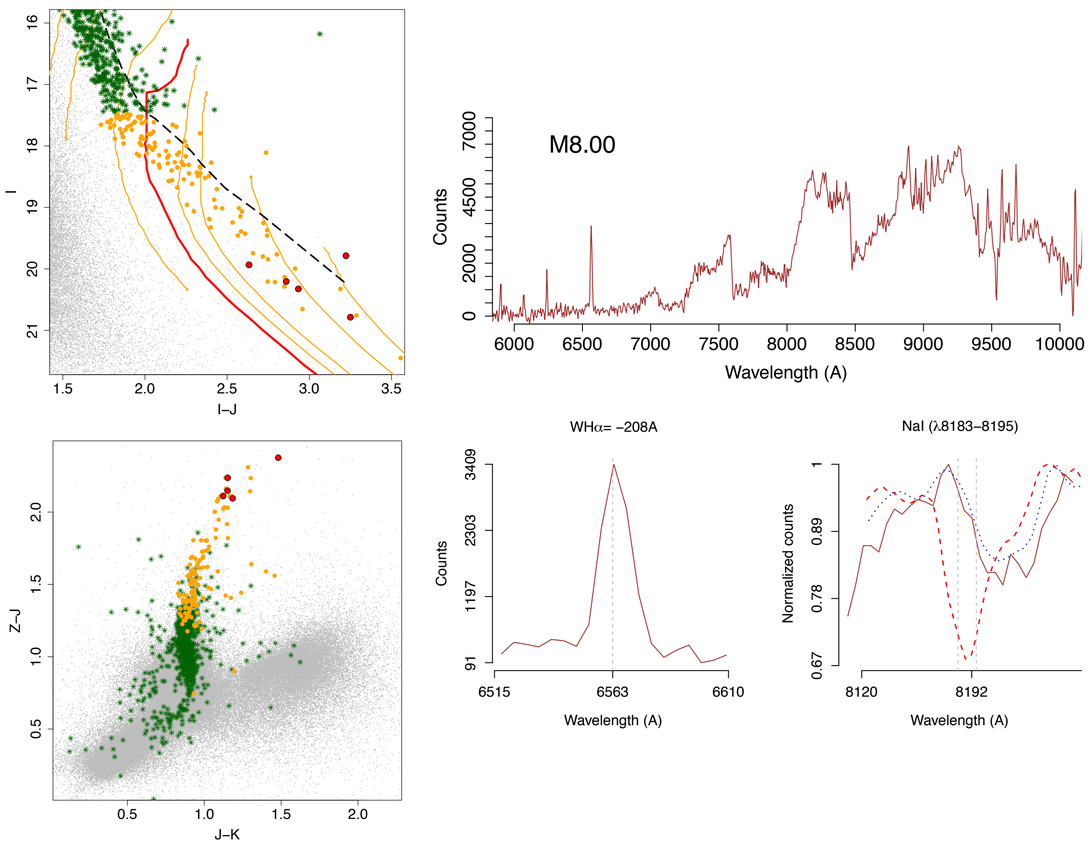

Figure 1. **Top left:** I vs. I-J diagram used as part of the candidate selection. Green: VLMS candidates. Orange: BDs candidates. Red: New confirmed BDs. Dashed line: 7Myr isochrone . Solid lines: evolutionary tracks for 0.01 to 0.5$M_\odot$. (from Baraffe et al 1998) **Right:** Spectra of a new confirmed BD indicating the Hα emission and NaI absorption. The red and blue lines indicate respectively the NaI for an old and a young dwarf of the same spectral type. **Lower left:** Distribution of candidates and members in a VISTA color-color diagram.

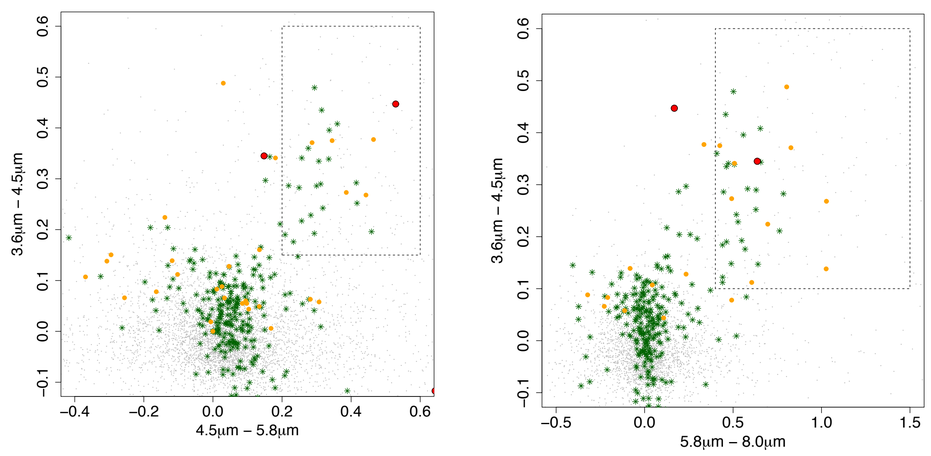

Figure 2. Distribution of candidates and new members in IRAC color-color diagrams showing the excesses loci from Luhman et al. (2005) and Hartmann (2005). Two new BD members (M6 and M9) show strong IR excesses in addition to accretion signatures (Figures 4).

III. THE system-IMF

We computed the system-IMF of the 25 Orionis group from the photometrically selected candidates. We appropriately substracted the expected contamination from field stars using results from the Besançon models (Robin et. al. 2003). The number of new confirmed BDs is consistent with such expected contamination.

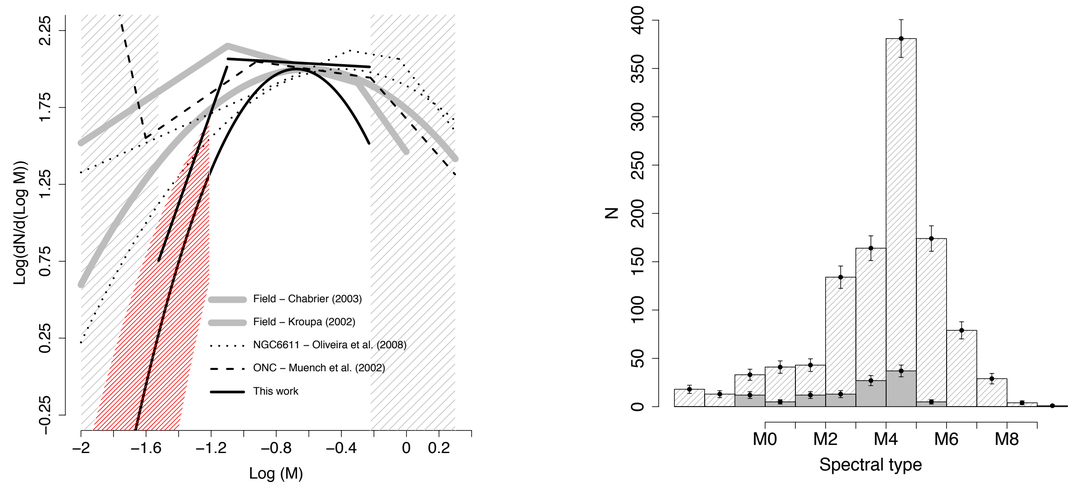

Figure 3. **Left:** The log-normal and power-law system-IMF of the 25 Ori group (solid black lines). Red area: uncertainty in the fit of the log-normal system-IMF. Gray dashed-area: incompleteness of our survey. **Right:** Distribution of candidates spectral types(dashed) and members (gray) from Briceño et al. (2005, 2007) and Downes et al. (2013a in prep).

IV. DISKS AND ACCRETION IN ~7 Myrs OLD BDs

From the 5 new BD members confirmed, 3 show accretion signatures and 2 of them exhibit strong IR excesses in IRAC bands (Figure 2). The remaining accretor (the strongest Hα emitter) has a modest 0.1 mag excess in the 3.6μm - 4.5μm color. We considered these 3 objects as accreting BDs.

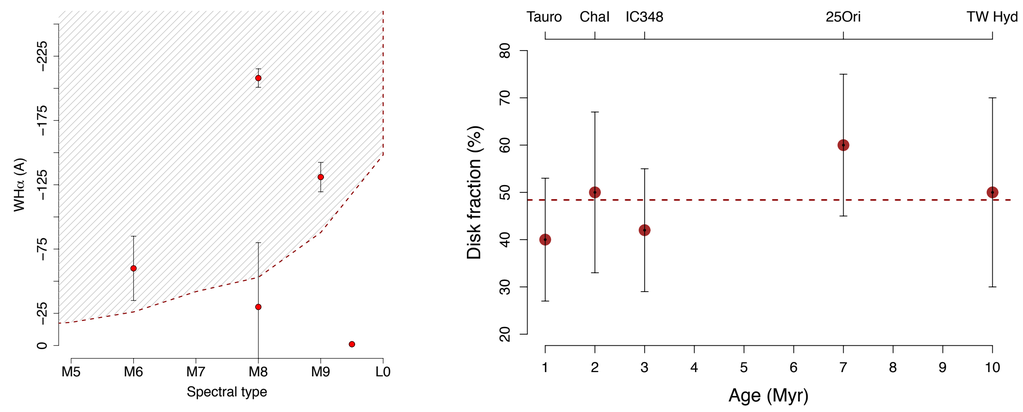

Figure 4. **Left:** Selection of accreting BD according to Barrado y Navascués et al. (2003). **Right:** Fraction of BDs showing disks for different regions and ages. We include results from different surveys reported in the literature. Dashed line indicates the mean fraction for all the regions.

V. SUMMARY AND CONCLUSIONS

The system-IMF derived from photometric candidates in the mass range (0.5<M/Mo<0.03) suggests a number of BDs lower than is expected from a universal system-IMF (Chabrier, 2003).

Up to now only two ~10 Myr old BDs (in the TW Hyd association) are known to be accretors. We report 3 new ~7 Myr old BD (M6, M8 and M9) showing accretion signatures. This corresponds to 60±15% of the new BDs found in the 25 Orionis group, which is consistent with the idea that BD disks may not dissipate until after ~10Myr (Sholz et al. 2007, Bouy et al 2007, Riaz & Gisis 2008, Riaz et al. 2009).

REF: Baraffe et al. 1998 A&A 337,403 ; Barrado et al. 2003 AJ,126,2997B ; Bouy et al. 2007 A&A, 463,641 ; Briceño et al. 2005 AJ,129,907B ; Briceño et al. 2007 ApJ,661,1119B ; Chabrier 2003 ApJ,586,L,133C, Hartman et al. 2005 ASPC,341,131H ; Luhman et al. 2003 ApJ,593,1093L ; Luhman et al. 2005 ApJ,631L,69L ; Petr-Gotzens et. al. 2011 The Messenger,145,29 ; Riaz & Gisis 2008 ApJ, 681, 1584 ; Riaz et al. 2009 ApJ, 701, 571; Sholz et al. 2007 ApJ, 600,1517.