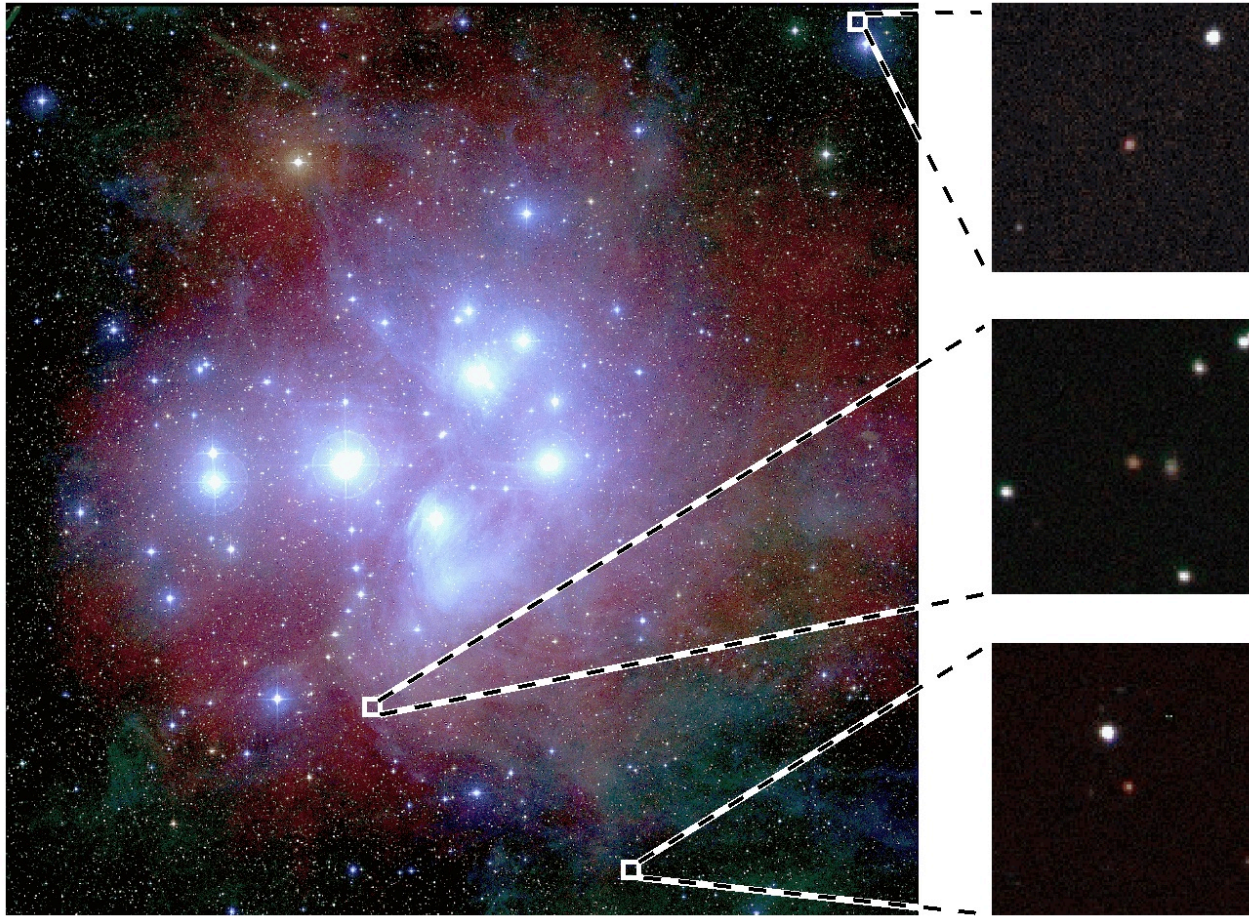


UKIDSS: Galactic Clusters Survey

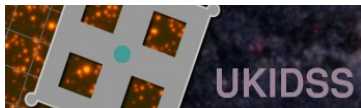
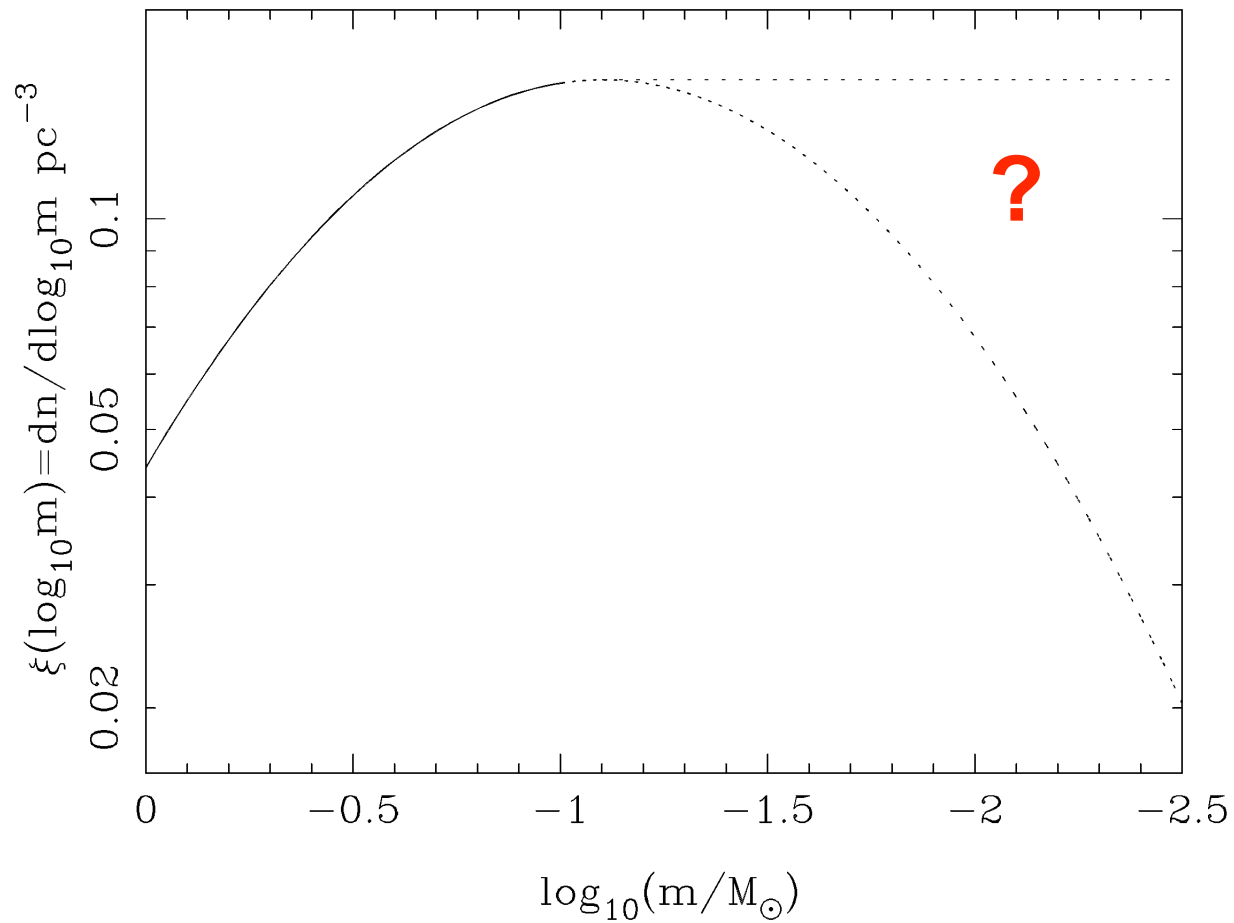


Sarah Casewell
University of Leicester
on behalf of the GCS Working Group



Motivation

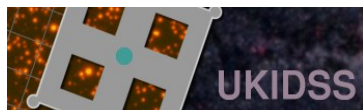
Stellar IMF (Chabrier 2003: PASP 115, 763)



So, require to measure the IMF into the substellar regime in order to:

- **Test the functional form**
 - **is it smoothly varying?**
 - **is there a characteristic mass?**
 - **what is the significance of BDs?**
- **Test the “universality”:** are there variations with environment?

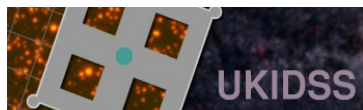
⇒ critically confront the latest star formation models and provide input into models of Galactic evolution.



The GCS targets

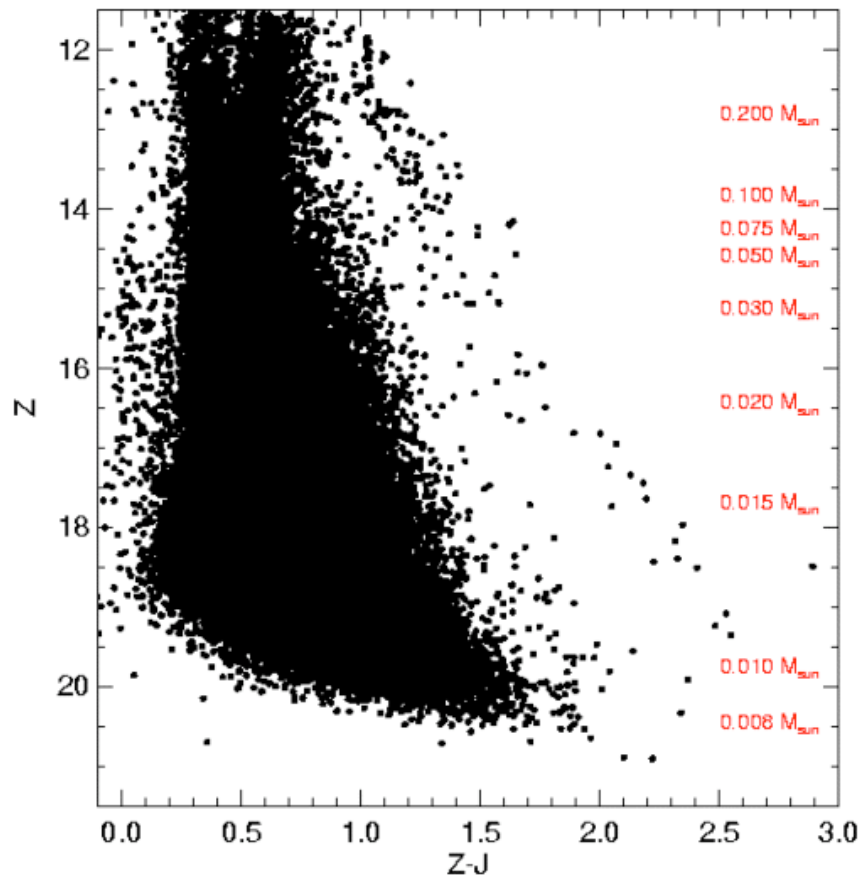
Priority/Name	Type	RA (2000)	Dec. (2000)	Area (deg ²)	Age (Myr)	Minimum mass (M _⊙)
(1) IC 4665	Open cluster	17 46	+05 43	3.1	40	0.020
(2) Pleiades	Open cluster	03 47	+24 07	79	100	0.024
(3) Alpha Per	Open cluster	03 22	+48 37	50	90	0.025
(4) Praesepe	Open cluster	08 40	+19 40	28	400	0.046
(5) Taurus–Auriga	SF association	04 30	+25 00	218	1	0.010
(6) Orion	SF association	05 29	−02 36	154	1	0.014
(7) Sco	SF association	16 10	−23 00	154	5	0.010
(8) Per-OB2	SF association	03 45	+32 17	12.6	1	0.011
(9) Hyades	Open cluster	04 27	+15 52	291	600	0.041
(10) Coma-Ber	Open cluster	12 25	+26 06	79	500	0.043

- **10 open clusters / star formation associations spanning a range of age & environment**
- **Multicolour imaging with 5s point source depths (Vega):
Z : 20.4 Y : 20.3 J : 19.5 H : 18.6 K : 18.2**
- **Two epochs in K for proper motions to ~10 mas/yr**
- **Complete areal coverage**

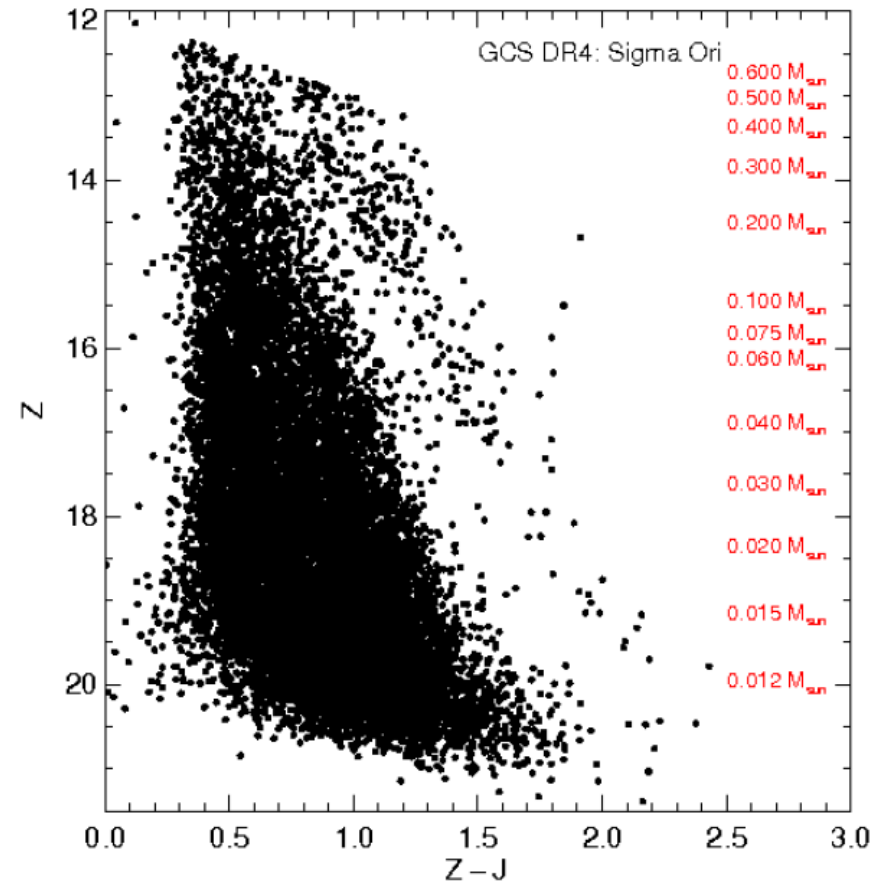


Examples of the data

Upper Scorpius SF region (SV):

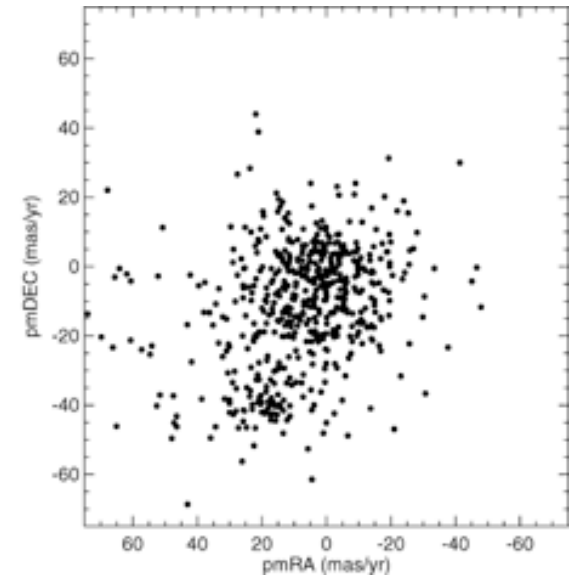
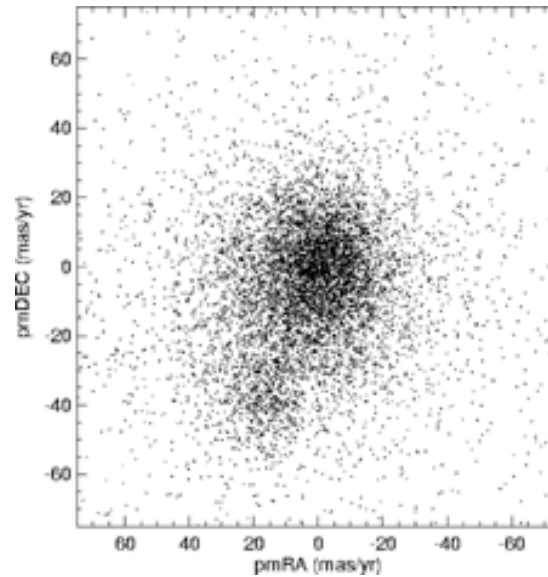
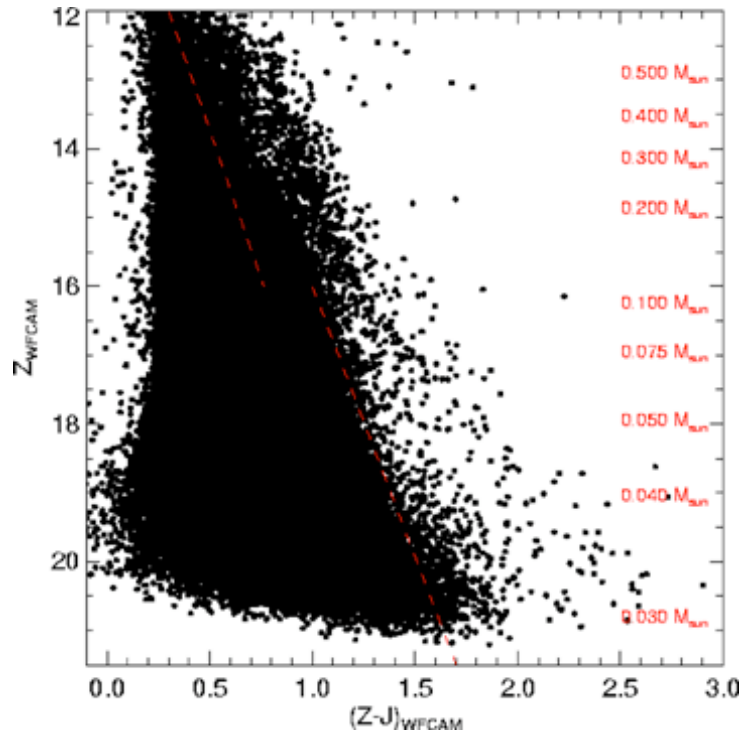


Sigma-Orionis (DR4):



More examples...

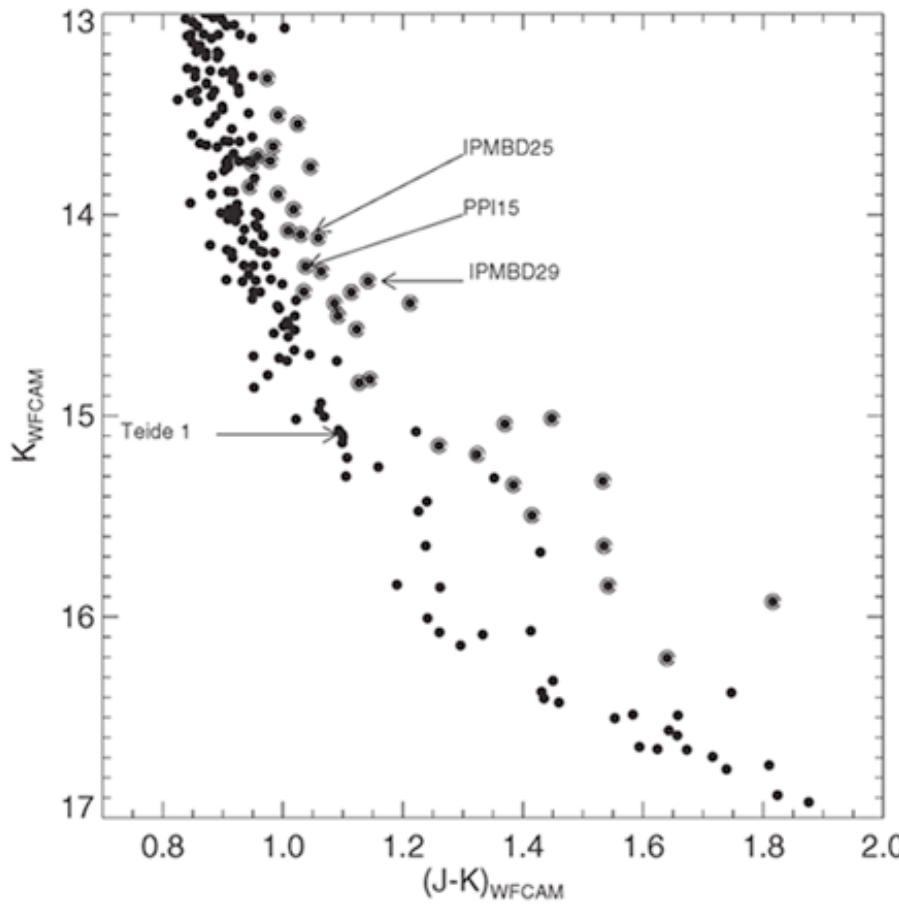
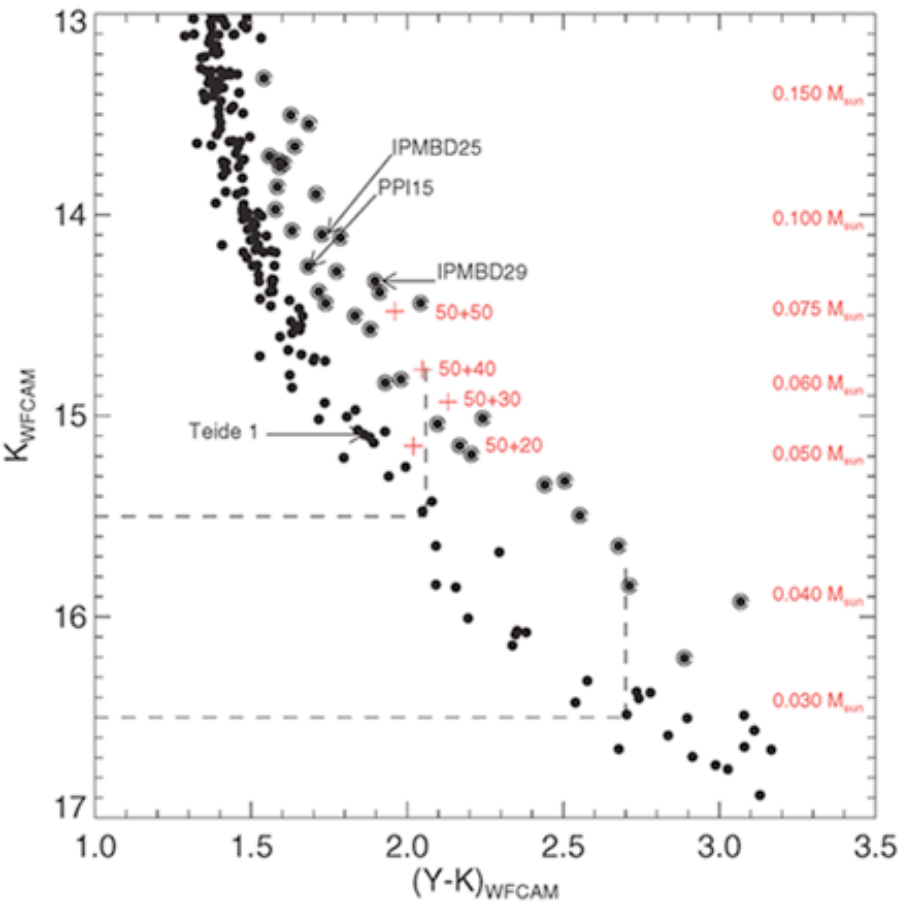
The Pleiades open cluster (DR1):



(proper motion selection via non-GCS
1st epoch imaging)



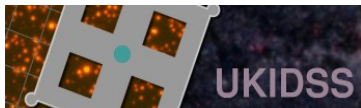
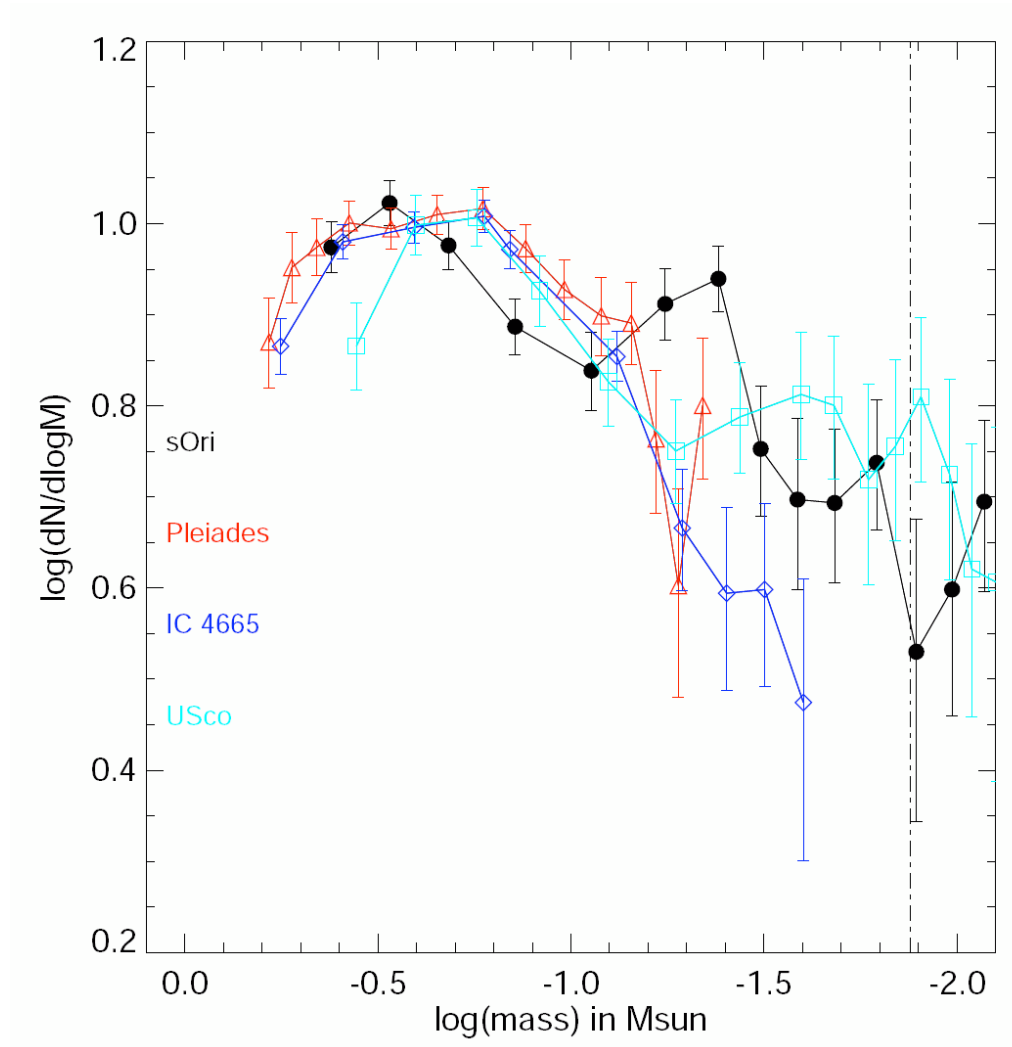
Unresolved binarity



Binary fraction is up to ~50%



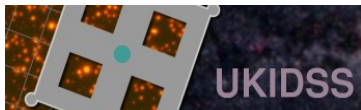
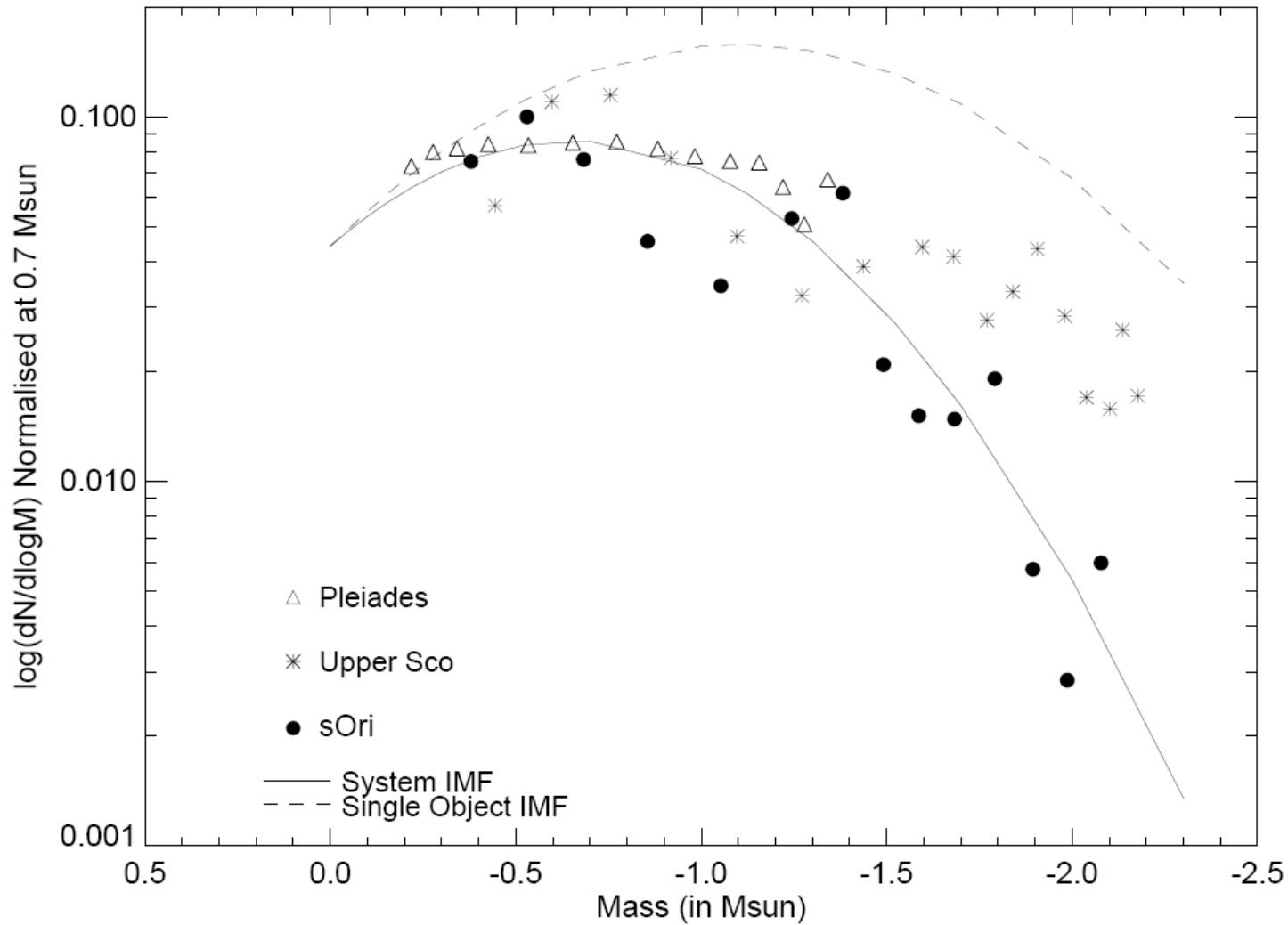
Comparison of “system” IMFs



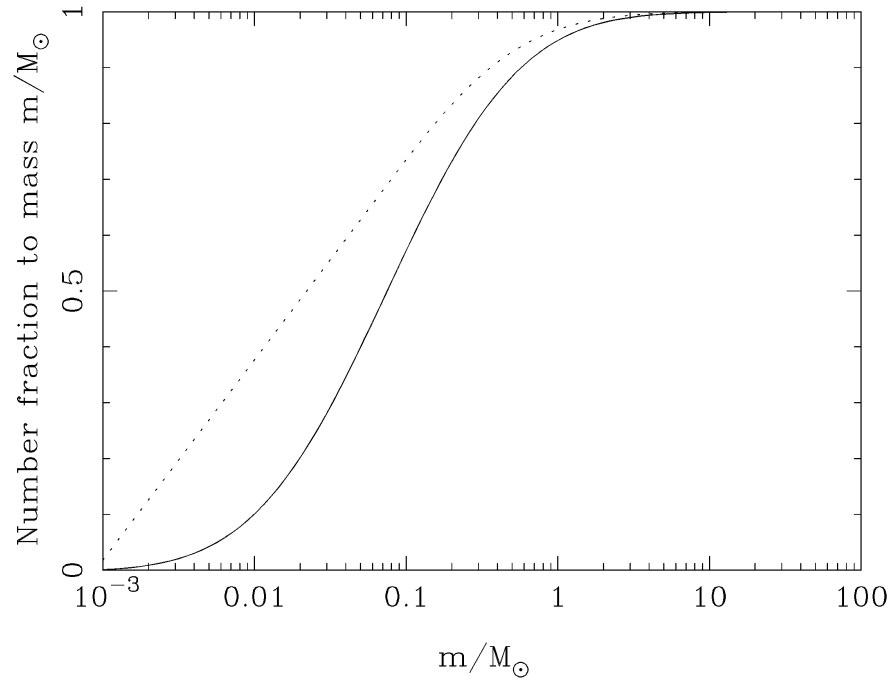
Galactic Clusters Survey

UKIRT@30:
A British success story

The substellar Initial Mass Function to $\sim 10 M_{\text{Jup}}$

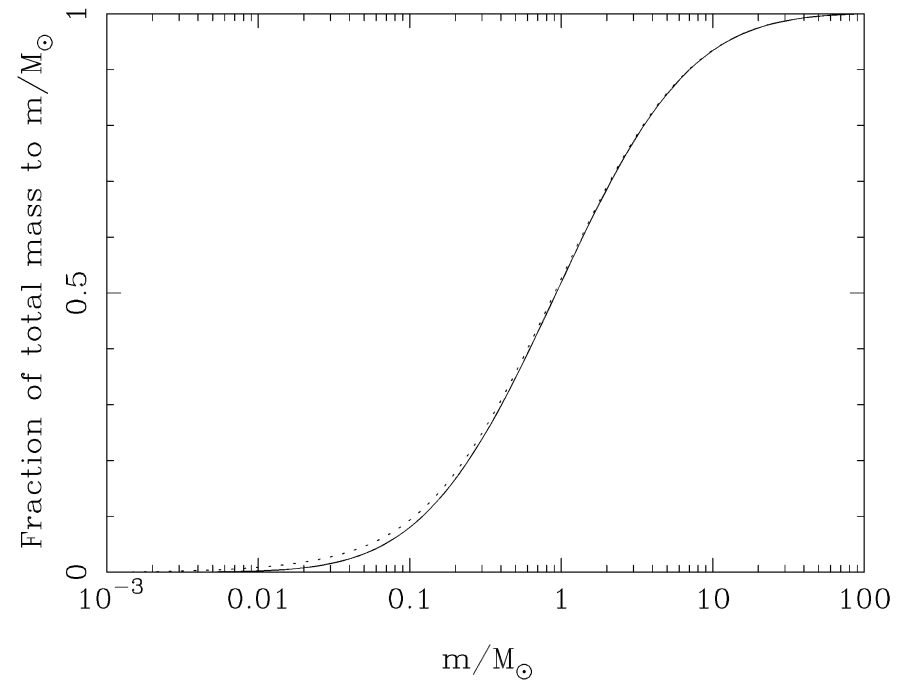


Significance of substellar objects



... by number
(dotted lines = flat IMF)

By mass ...



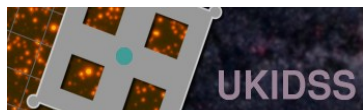
Other things being done with the GCS...

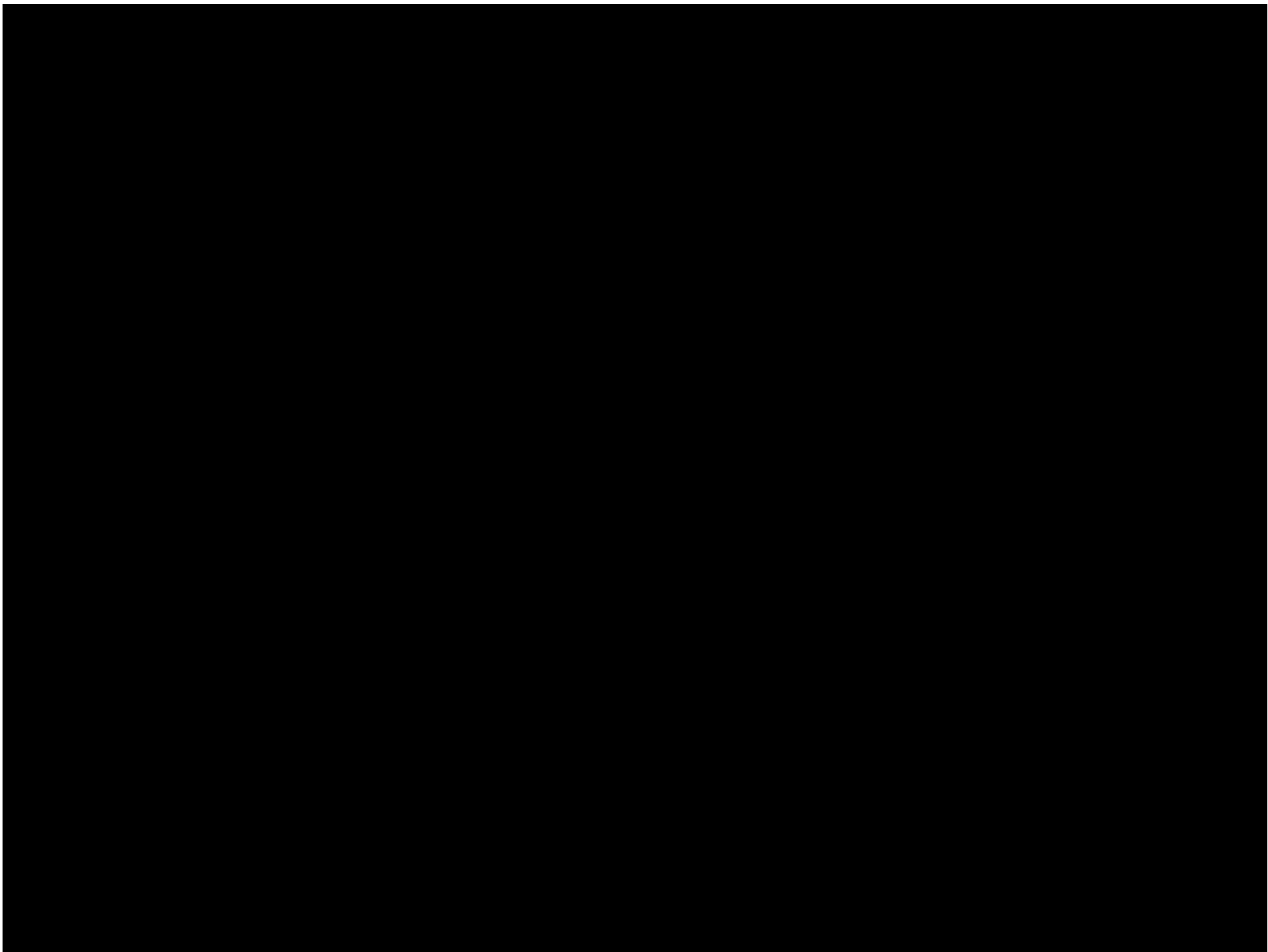
- T/Y dwarf search (with LAS)
- M/L proper motion search (with LAS)
- high-z QSO search (with LAS)
- New stellar clumps & disk candidates in Taurus & Orion
- Age calibration for field L dwarfs
- Legacy, serendipitous imaging, e.g. WDs in Praesepe
- ...



Conclusions

- IMF appears to be log-normal in the substellar regime, rather than flat (or even rising), with characteristic mass \sim HBMM
- there are as many substellar objects as stellar
- BDs do not contribute significantly to the total mass in stellar systems
- No evidence of a cut-off in BD formation down to masses of $\sim 10 M_{\text{Jup}}$
- Universality (or otherwise) of substellar IMF remains an open question ...





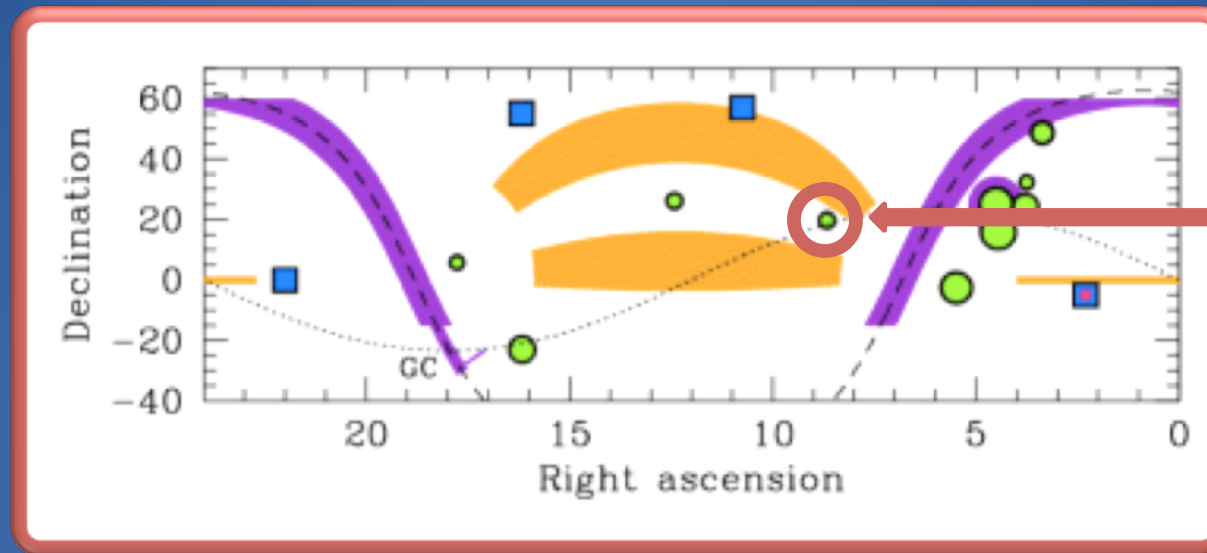
A Search for Brown Dwarfs in Praesepe with UKIDSS

By

David Baker

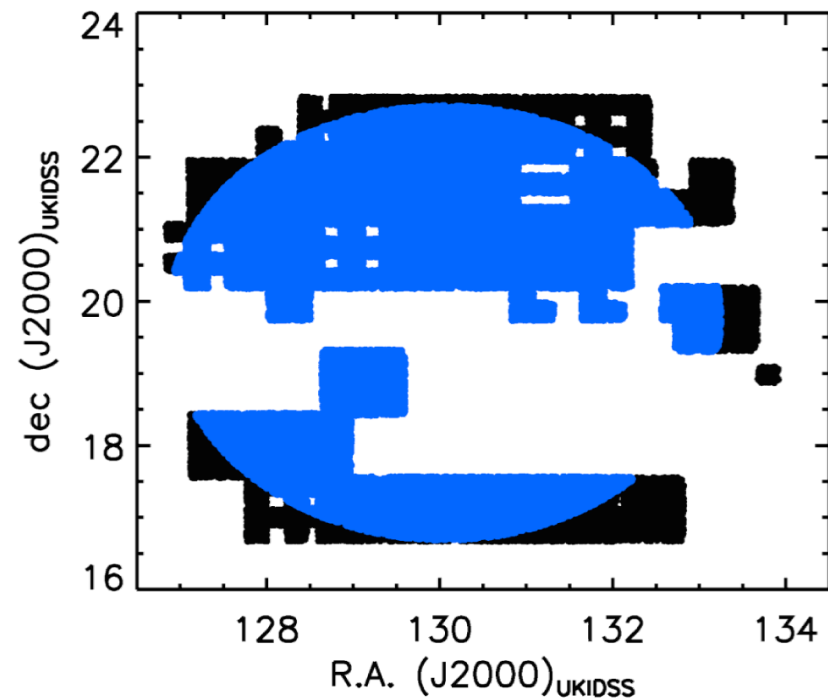
Supervisor: Richard Jameson

UKIDSS: The United Kingdom Infrared Deep Sky Survey

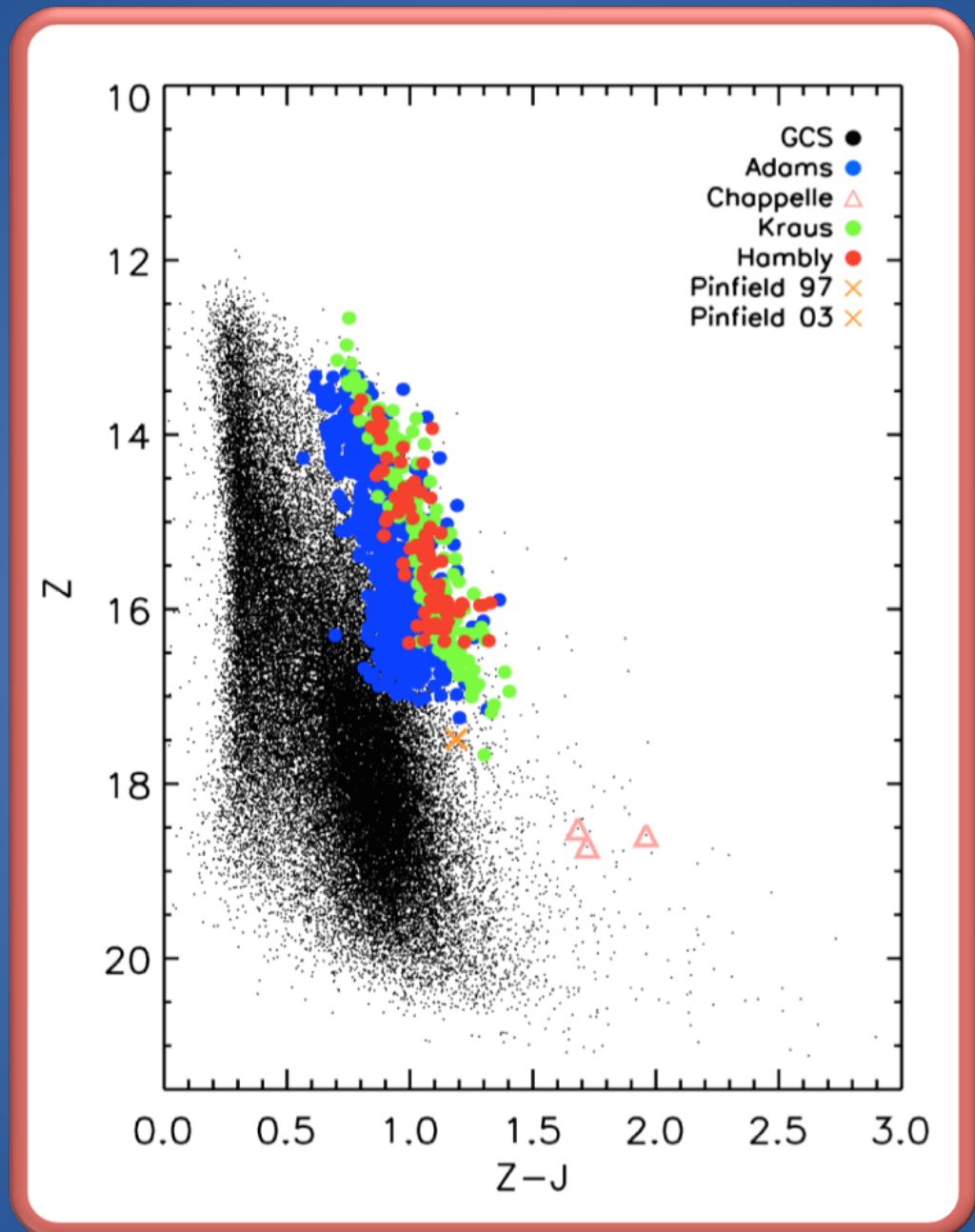


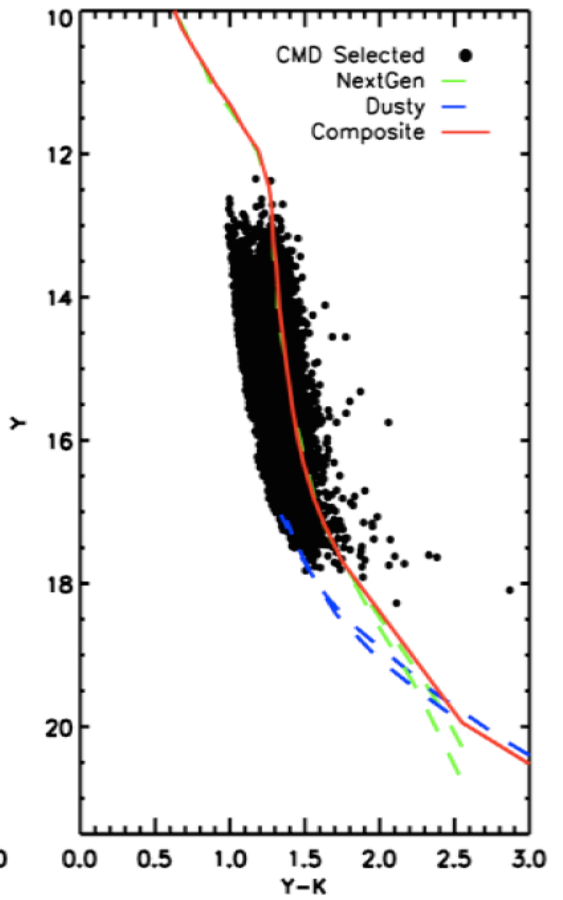
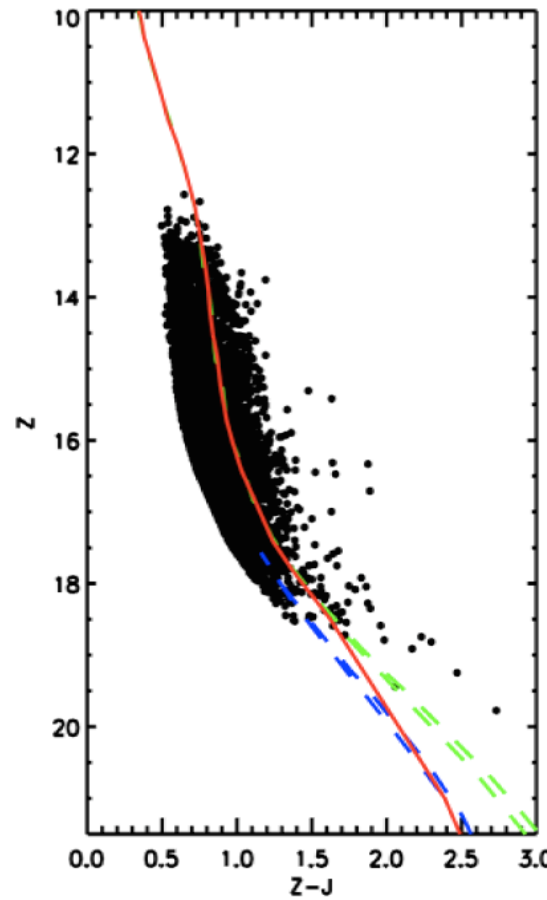
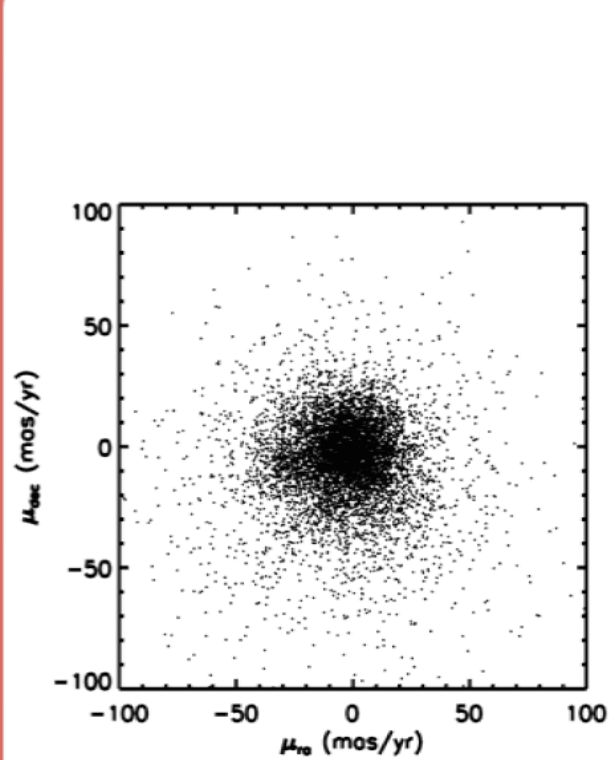
Praesepe

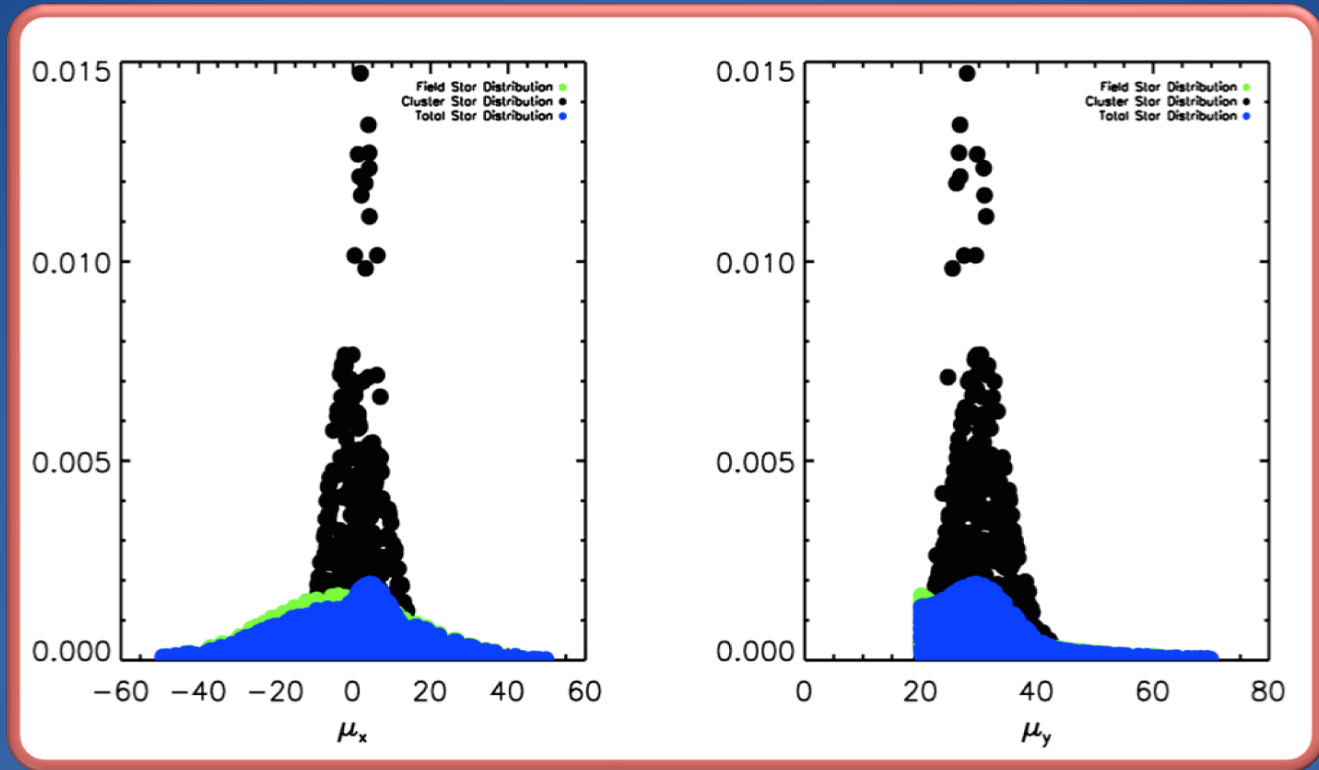
Age: 0.5 – 1 Gyrs
Distance: 170 Pc
Location: 125 - 135 Degrees Ra
+16 - +24 Degrees Dec
Solar Metallicity & Zero Reddening
Proper Motion Centre: -35.66 , -12.70



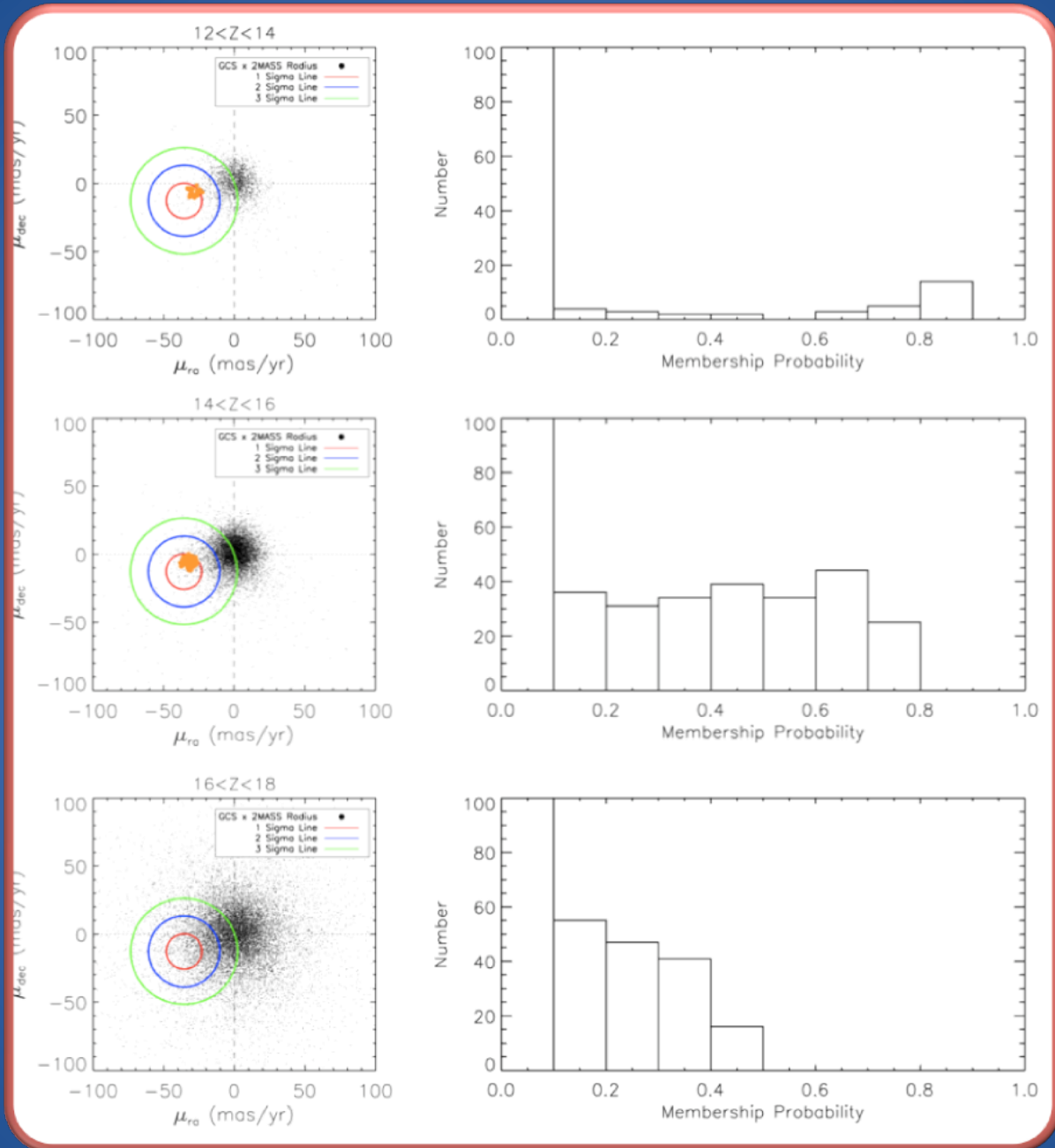
63,134 UKIDSS Sources
30,712 Matched to 2MASS
56,691 Matched to SDSS
32,825 Common to all 3 Surveys

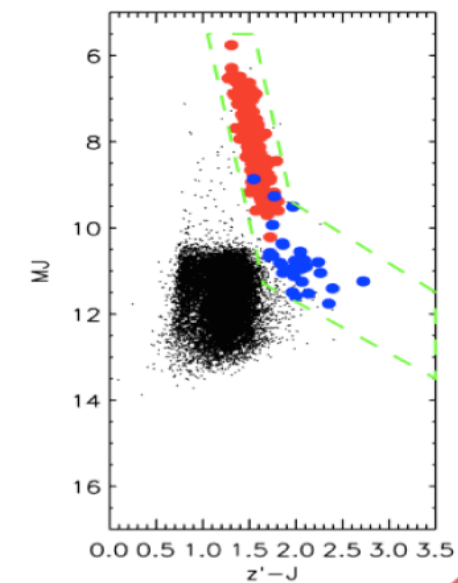
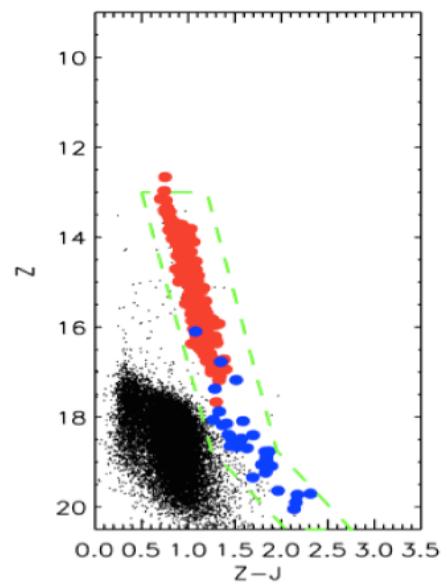
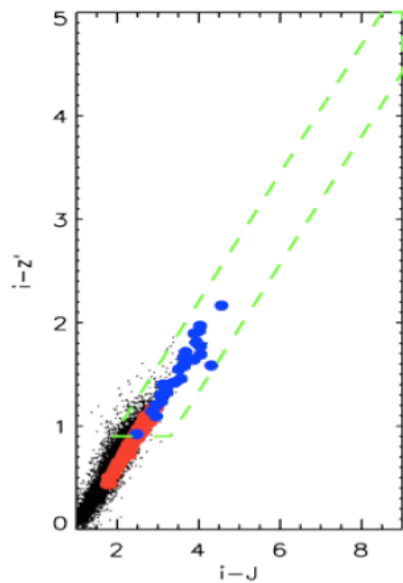
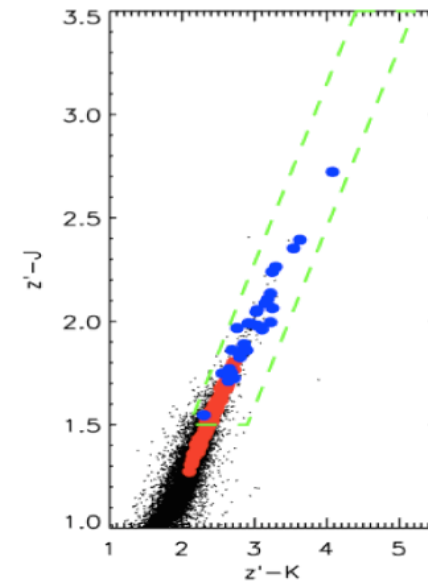
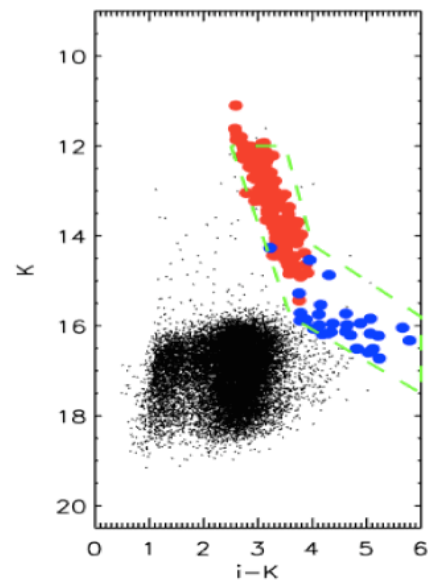
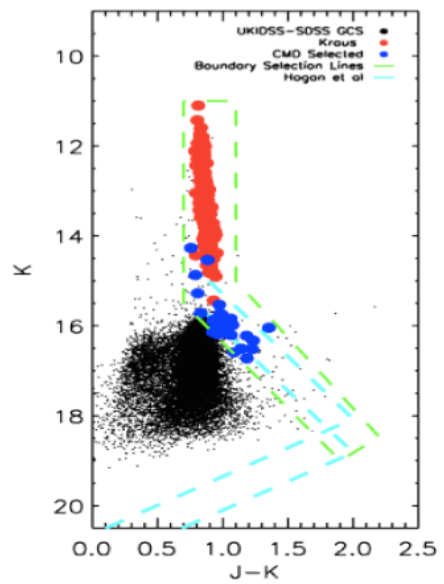


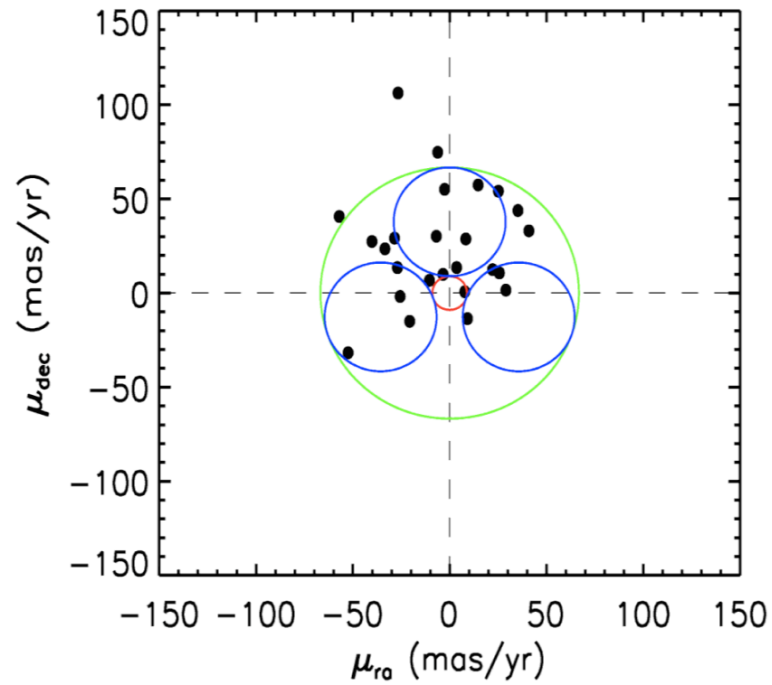




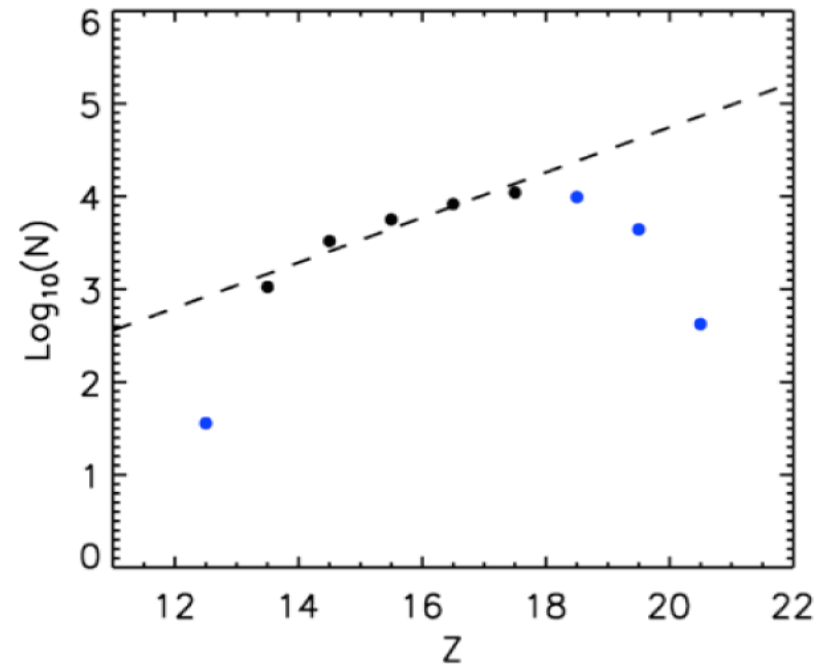
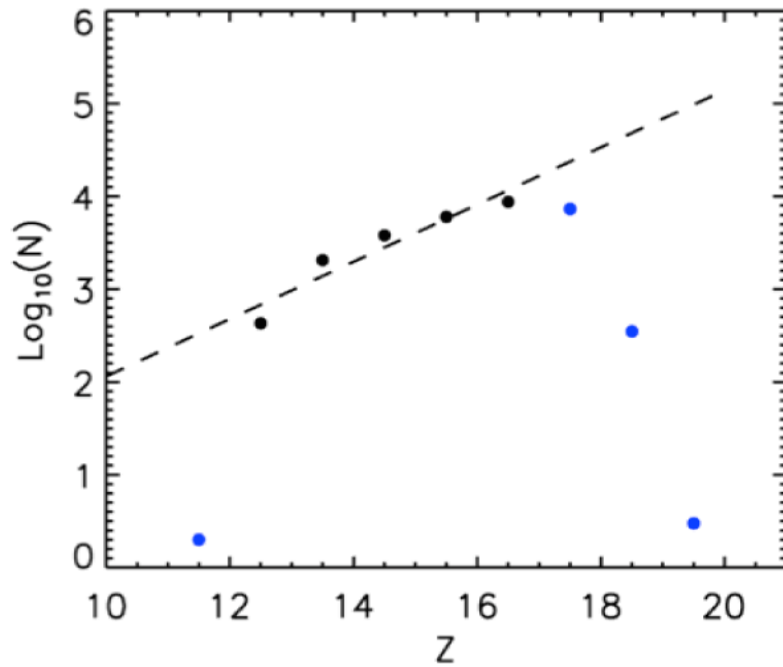
$$p_i = \frac{(1 - f)\Phi_{ci}}{\Phi_i}$$

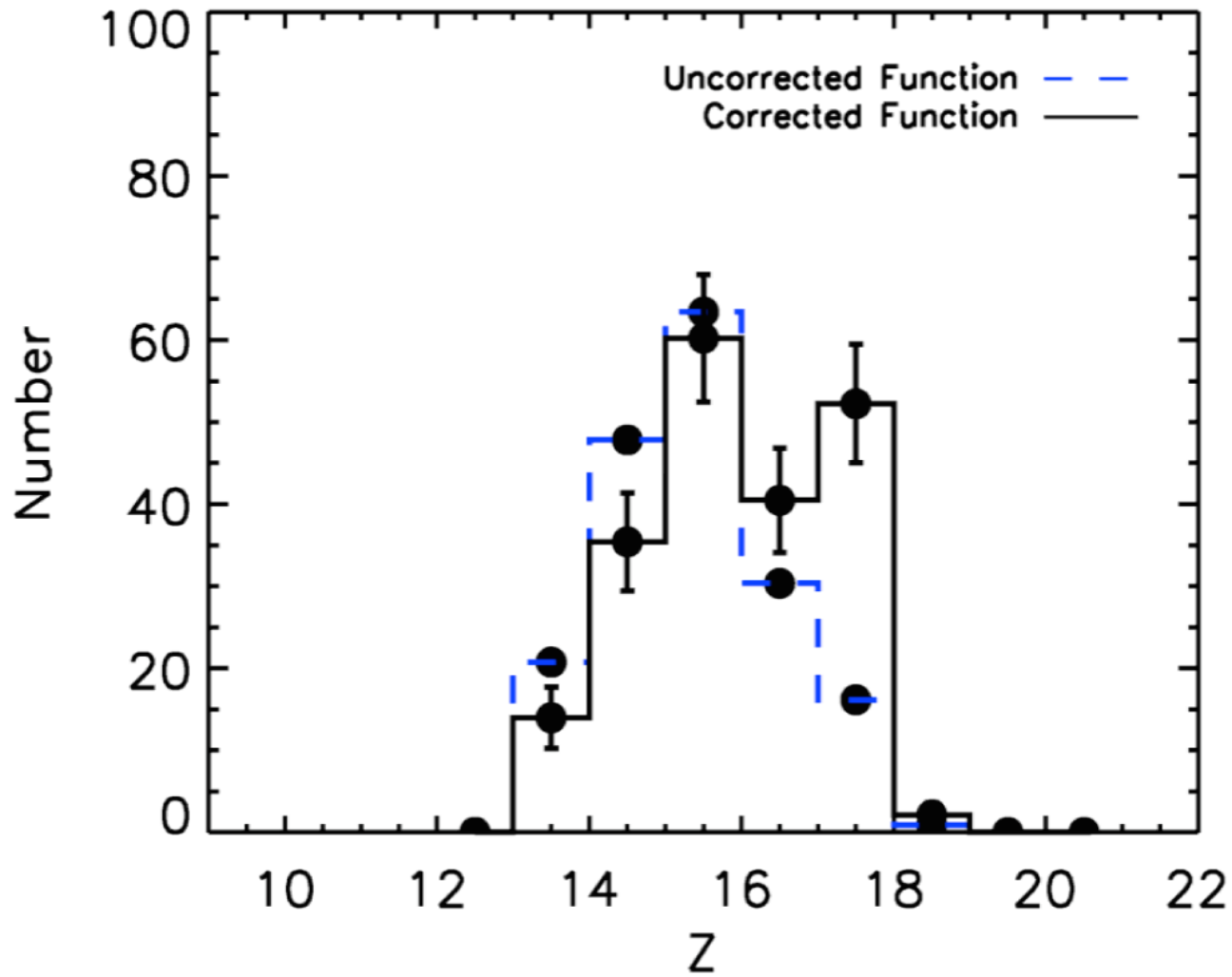


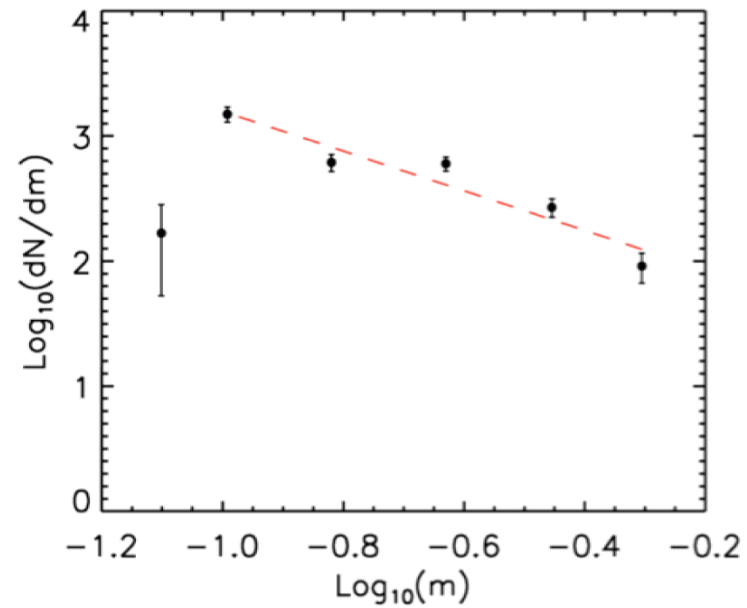
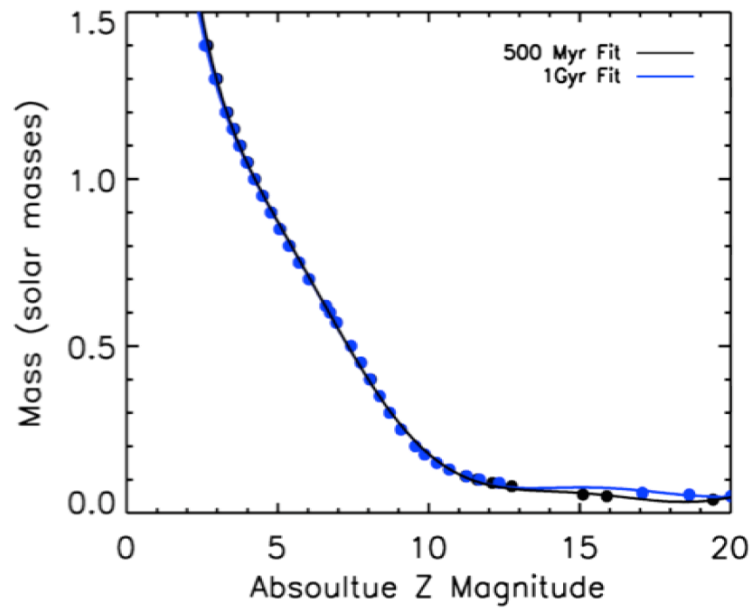




$$P_{\text{membership}} = \frac{N_{\text{cluster}} - N_{\text{control}}}{N_{\text{control}}}$$

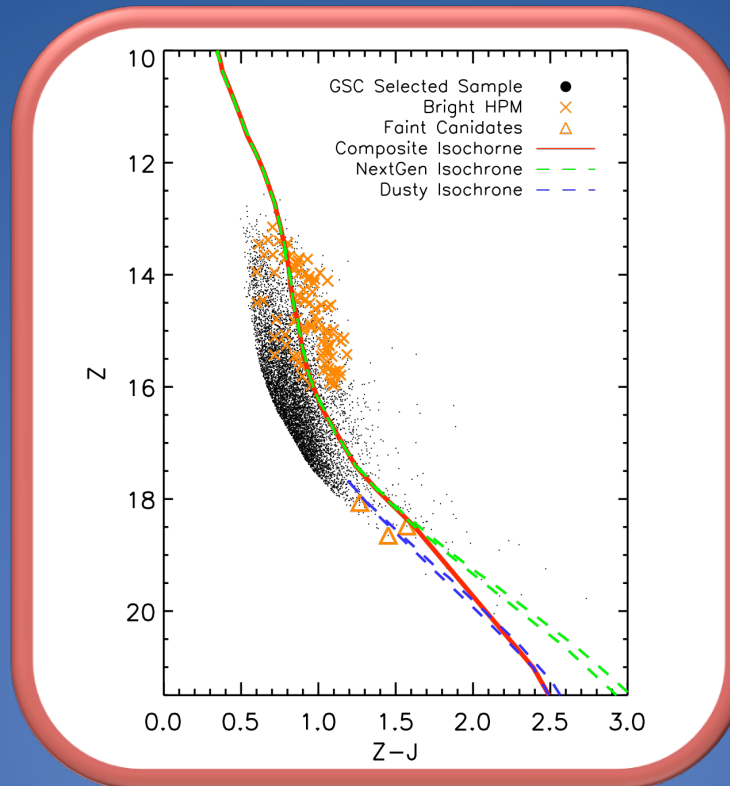




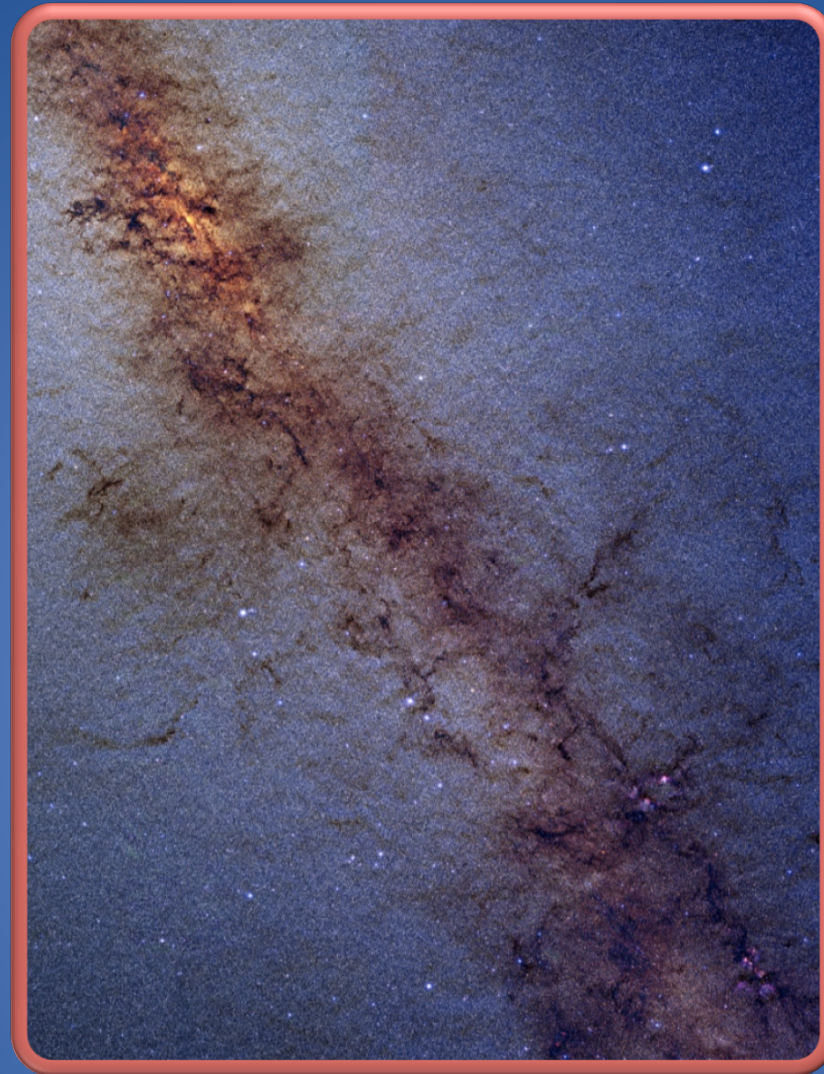


$$\alpha = 1.570 \pm 0.28 \text{ (500Myrs)}$$

$$\alpha = 1.584 \pm 0.28 \text{ (1Gyr)}$$



91 High Probability “Bright” Members (12 appear new)
3 “Faint” Candidates ($p \approx 0.3$ for each)
Cluster Luminosity and Mass Function
Power law fit with $\alpha = 1.57$ (500 Myr) and $\alpha = 1.58$ (1Gyr)



Credits and thanks to: Richard Jameson, Sarah Casewell, Nigel Hambly, Nial Deacon
&
Nicolas Lodieu

David Baker September 2009