TESTING THE UNIVERSALITY OF THE STELLAR IMF WITH THE E-ELT

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QUOTES

"Resorting to altering the initial mass function is a sign of moral weakness" Mike Edmunds

"... the last refuge for scoundrels" Mike Edmunds "All problems in extragalactic astrophyics can be solved by a suitable choice of the IMF" Romeel Dave

* IMF is one of the best hopes to constrain the process of star-formation

* Nearly all stellar properties of galaxies and populations are controlled by the IMF at some level.







high mass clusters rare -> far away -> can't get their low mass stars

due to stochasticity, need IMF in many clusters over the full mass range



NEED FOR EVER DEEPER OBSERVATIONS



Stolte et al. 2008

NEED FOR EVER DEEPER OBSERVATIONS



cluster	distance (kpc)	Mass (Msun)	lower mass limit
Cygnus OB2	1.7	~104	< 20 MJupiter
Trumpler 14	2.8	~ 104	< 20 MJupiter
NGC 3603	6.5	few * 104	< 0.02 Msun
Westerlund 1	5.5	>10 ⁵	< 0.02 Msun
Arches	8	few * 104	< 0.02 Msun

E-ELT: reaching into the substellar mass regime for all known Galactic young massive clusters

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While crowding will be an issue in the centers of the clusters, limits still possible outside the cluster cores



de Marchi, Paresce, & Portegies Zwart 2009, in prep.



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Wyse et al. 2002



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It has been claimed that the IMF may be dependent on the SFR *density*, hence it should vary with redshift.

Local stellar clusters (ONC, Arches, NGC 3603) have SFR densities orders of magnitudes larger than high-z galaxies.

IMF VARIATIONS IN EXTREME ENVIRONMENTS



Smith et al. 2006

IMF VARIATIONS IN EXTREME ENVIRONMENTS

Direct detection of low mass stars

Point sources: I=20-23, K=20.5-23.5



Smith et al. 2006

IMF VARIATIONS IN EXTREME ENVIRONMENTS



HIGH REDSHIFT UNIVERSE



MANY INDIRECT STUDIES REPORT IMF VARIATIONS

- ** Larson 2005
- Baugh et al. 2005
- Weidner, Kroupa, Pflamm-Altenburg et al. 2006, 2007, 2009
- ** Wang et al. 2006
- Fardal et al. 2007
- Maness et al. 2007

Mieske & Kroupa 2008
Wilkins et al. 2008a,b
Dave 2008
Hoversten & Glazebrook 2008
van Dokkum 2008
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CONCLUSIONS

Many lines of evidence point to the universality of the stellar IMF.

But absence of evidence is not evidence of absence.

The E-ELT will be able to refine the tests carried out so far, and search for variations in the sub-stellar regime.

INTERMEDIATE AGE CLUSTERS IN THE LMC



Mackey & Brobie Neilson 2007



Mackey & Brobie Neilson 2007











OUTLINE

Stellar IMF in the Galaxy

Resolved star approachUniversality of the IMF?

Extreme environments

Stellar IMF in starbursts and the early universe
Multiple populations within clusters?