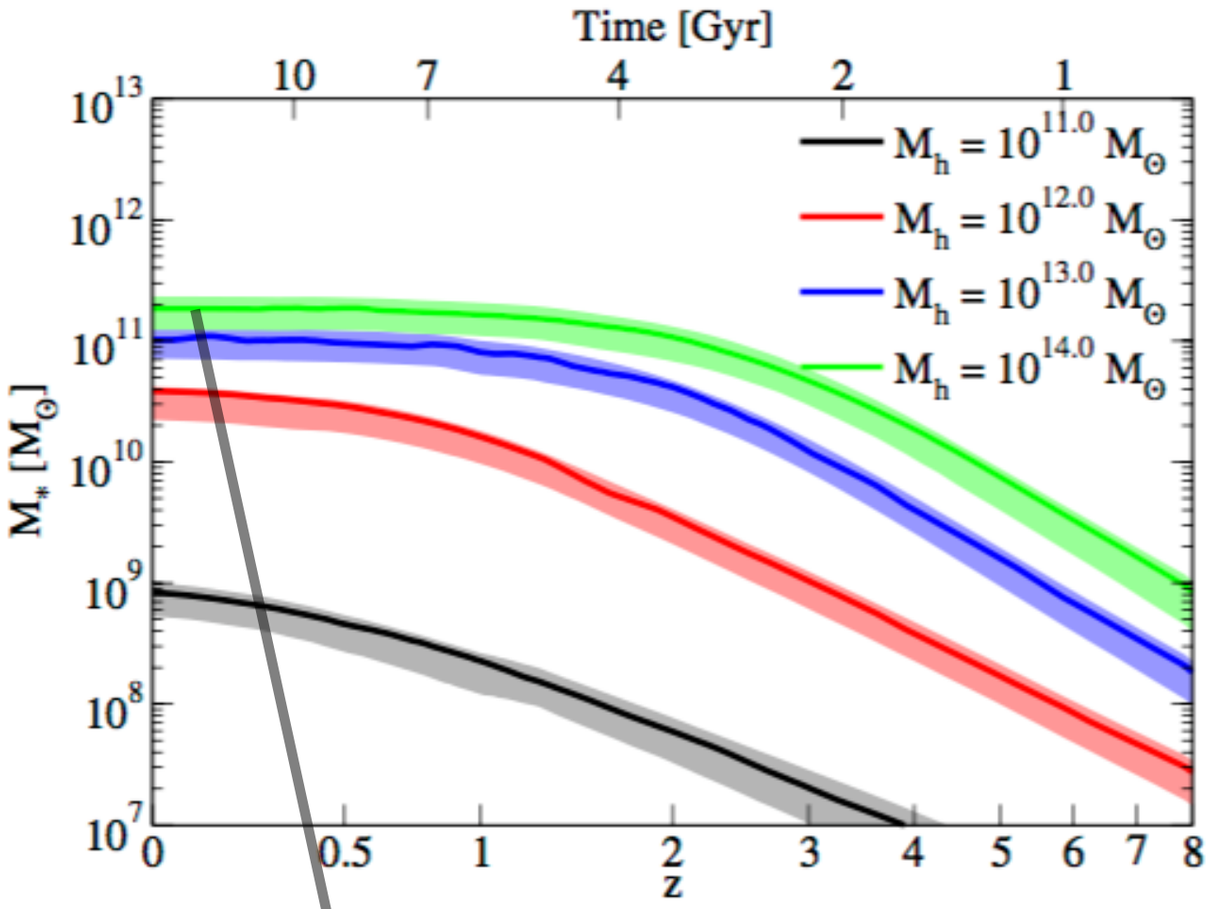
DECam at the Low Surface Brightness Limit
Detection of Diffuse Light in Galaxies and Galaxy Clusters

Intra-**C**luster **L**ight
(ICL)

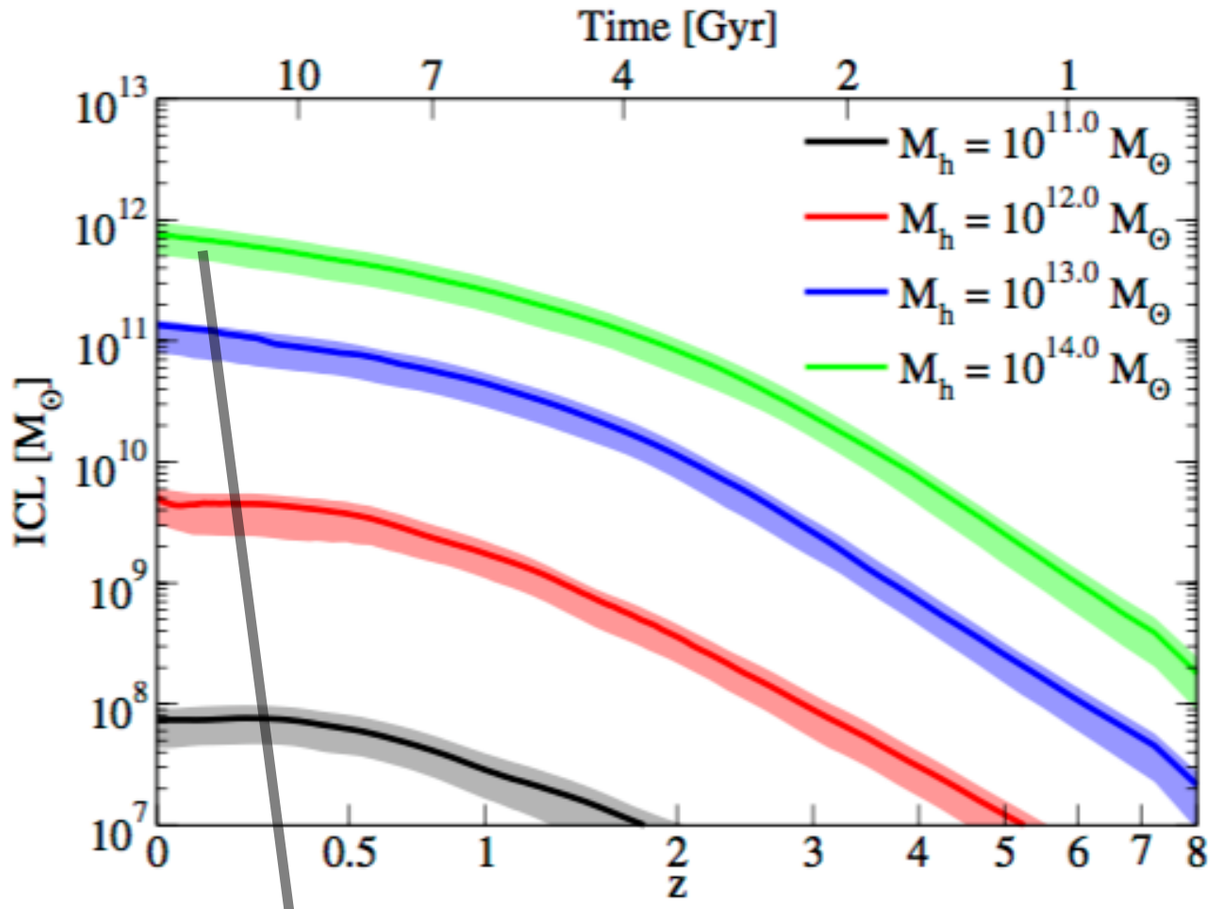
The Bullet Cluster
Image credit: E. Suchyta, P. Melchior, the DES collaboration

Speaker: Yuanyuan Zhang
(Fermilab)

Diffuse **I**ntra-**C**luster **L**ight (ICL) is potentially a (very) important component of galaxy cluster.



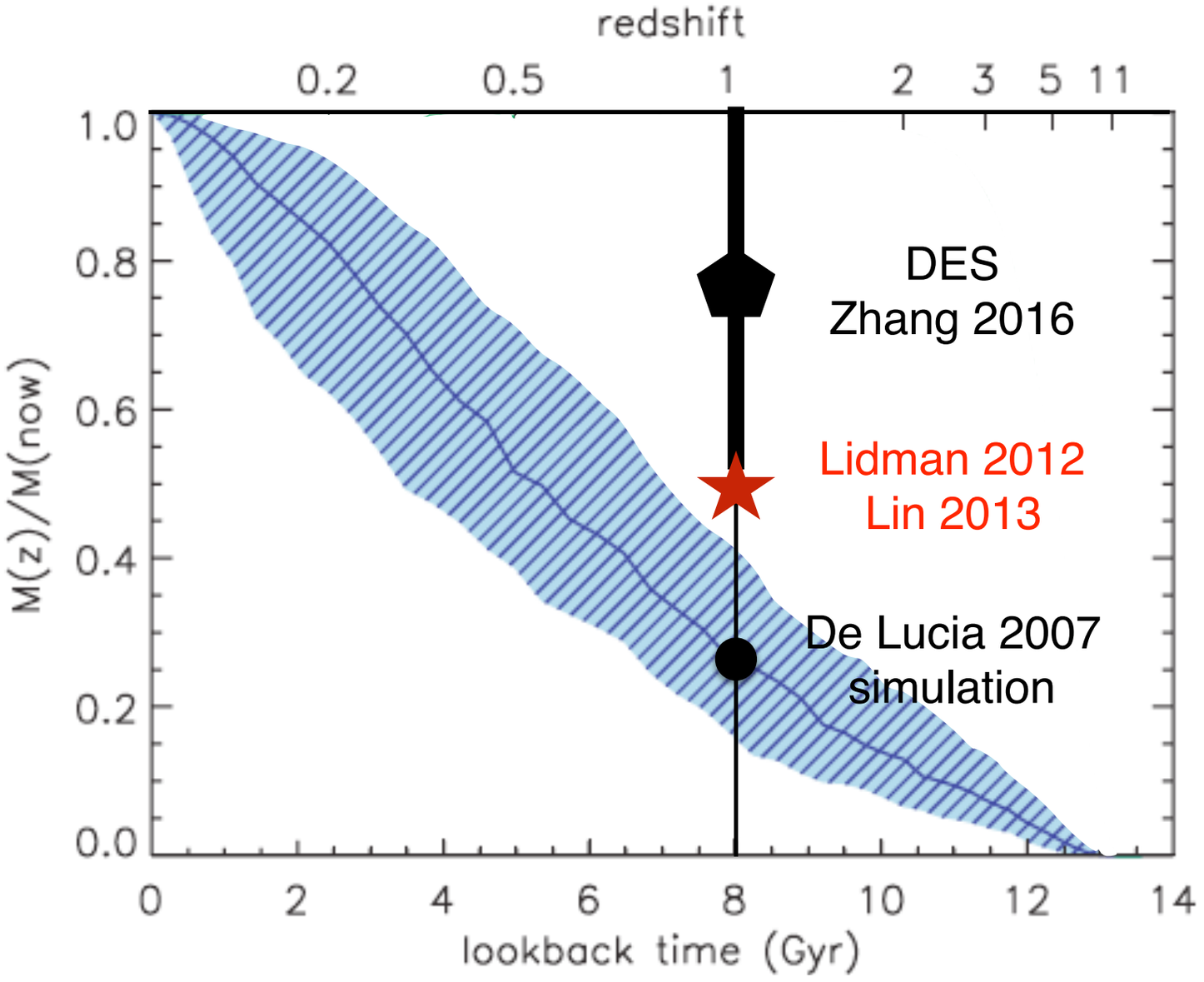
Central Galaxy (CG)



Intra-Cluster Light (ICL)

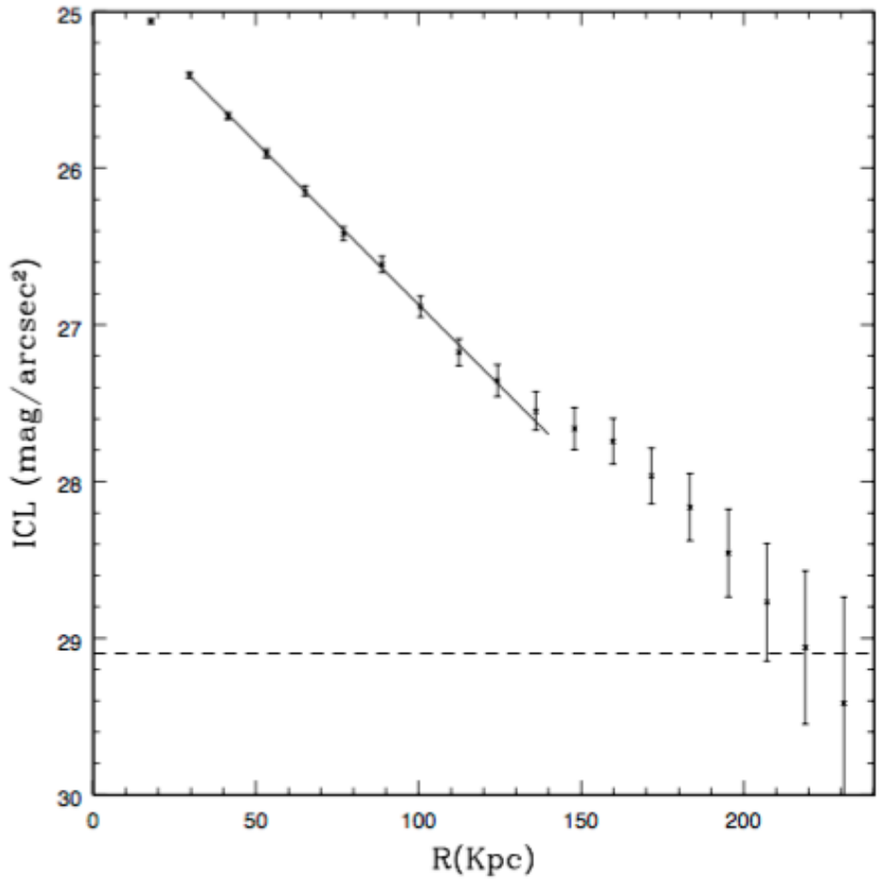
Behroozi 2013

Not considering ICL raises tensions in galaxy formation models.



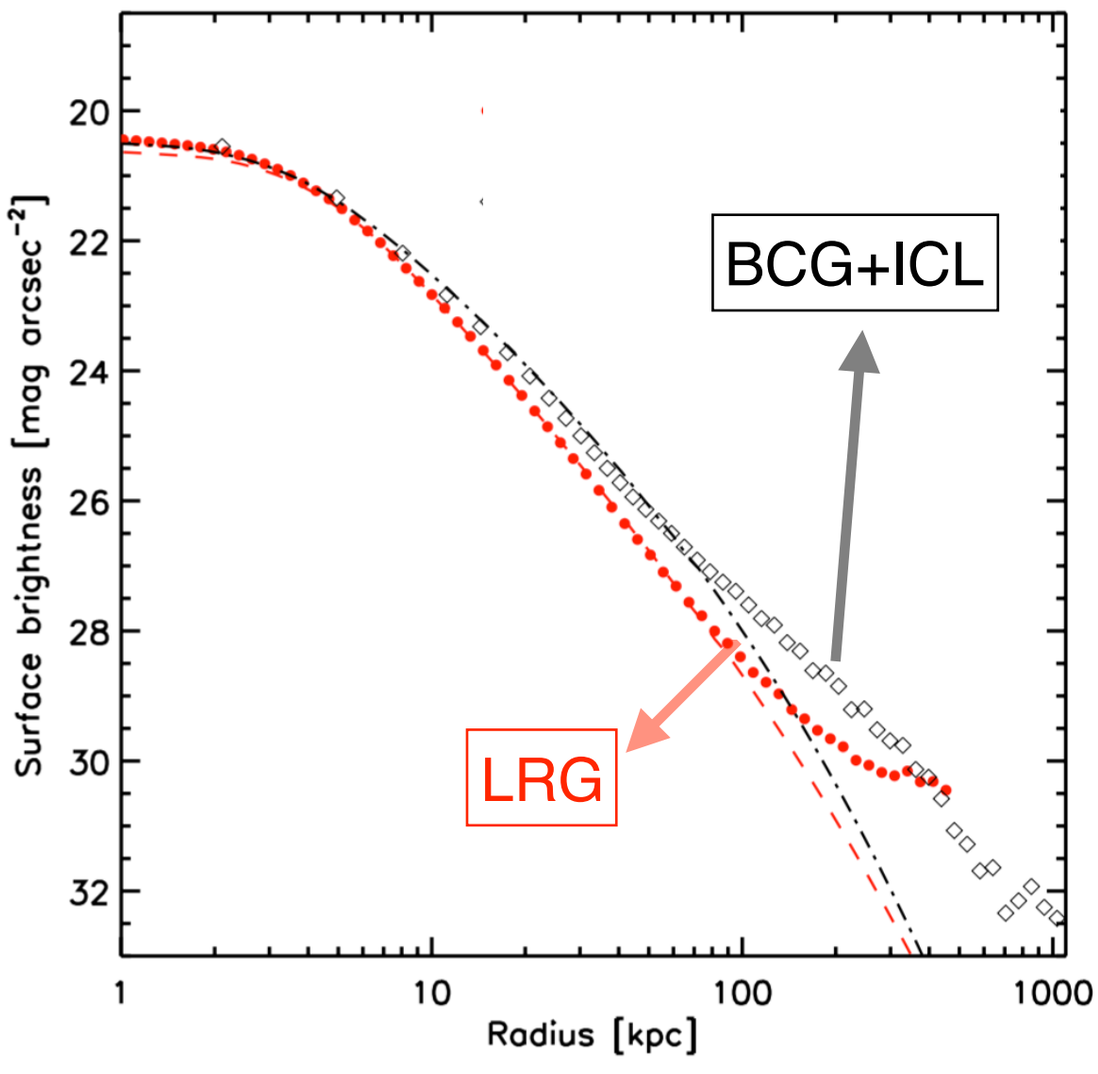
central galaxy stellar mass growth over time

Stacking clusters is an advantageous approach on studying diffuse light with wide field data.



Studying ICL in one cluster with LBT
Giallongo 2013

Stacking Clusters/LRGs with SDSS data
Zibetti 2005, Tal 2011



DECam/DES data allows us to apply this method again.

Stacking clusters is an advantageous approach on studying diffuse light with wide field data.

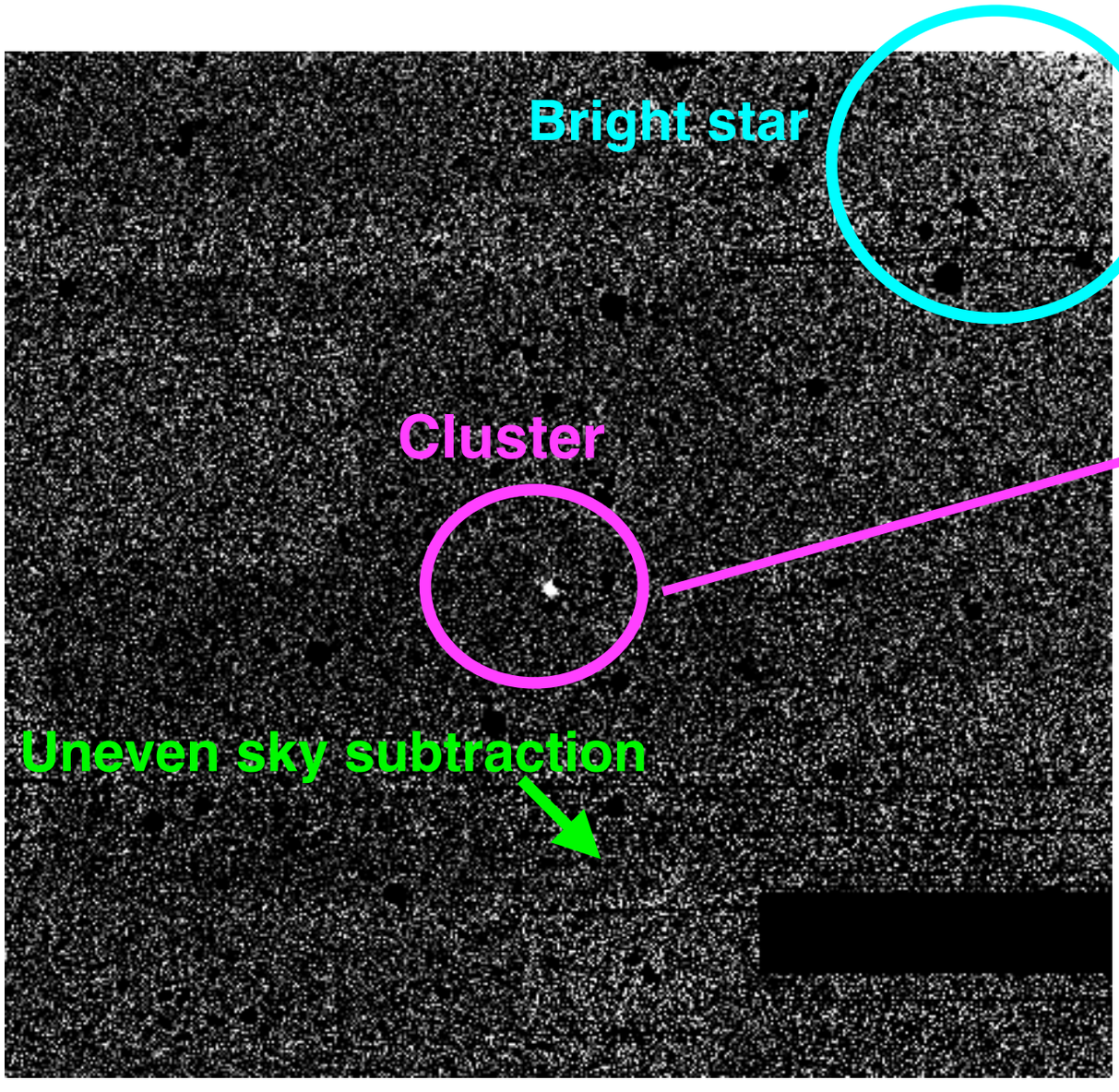
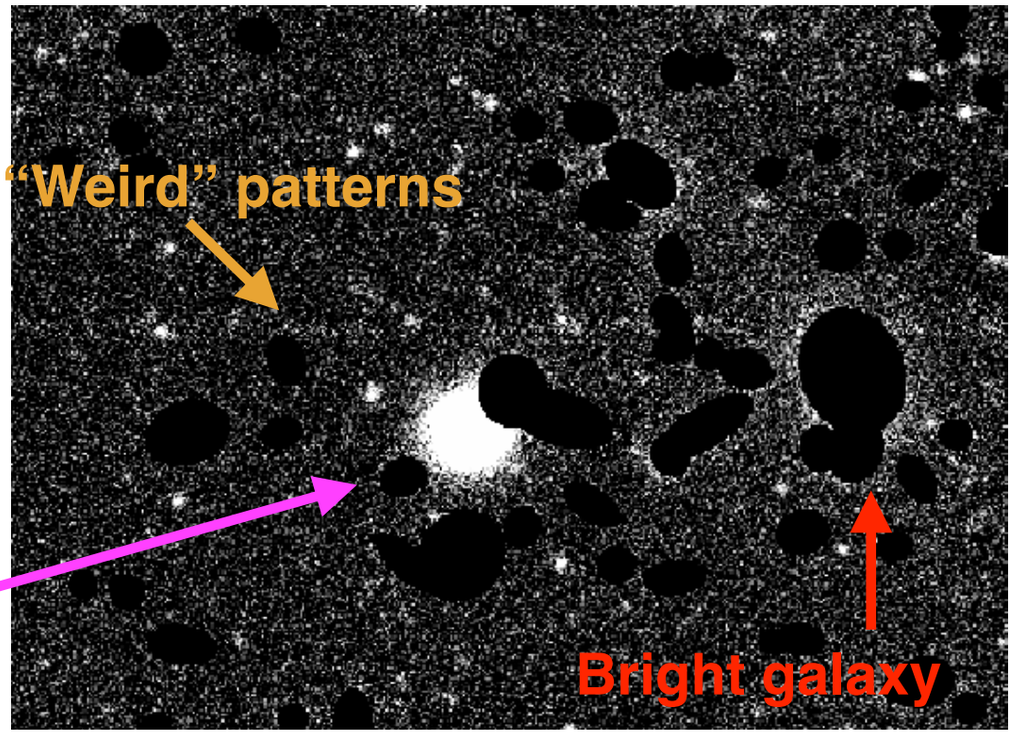
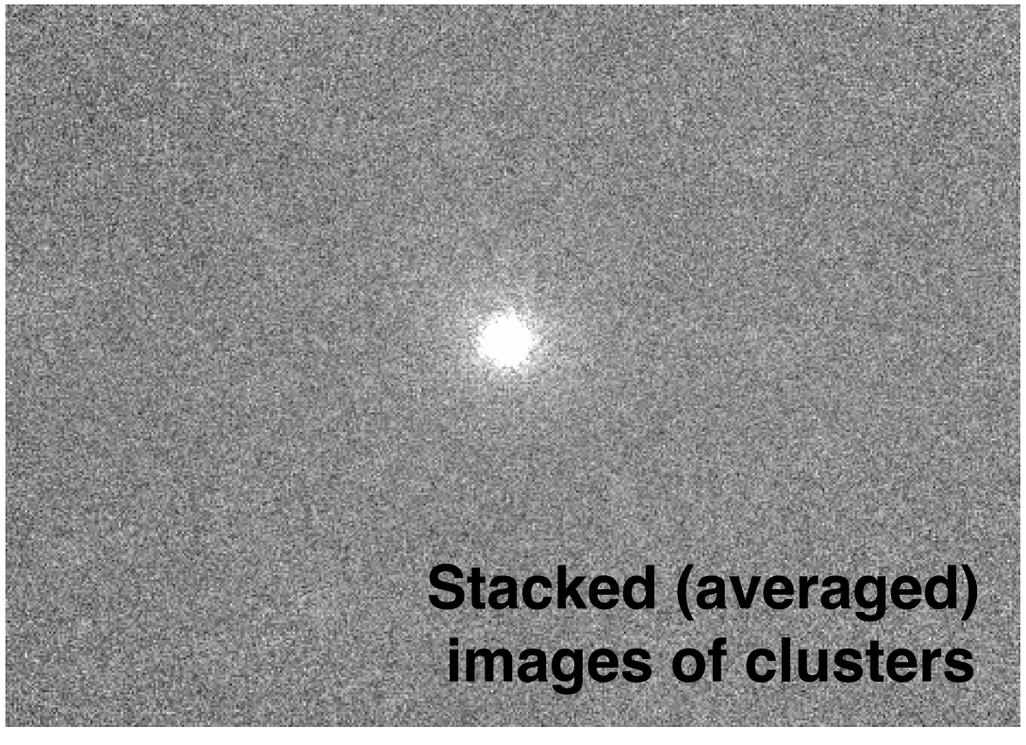


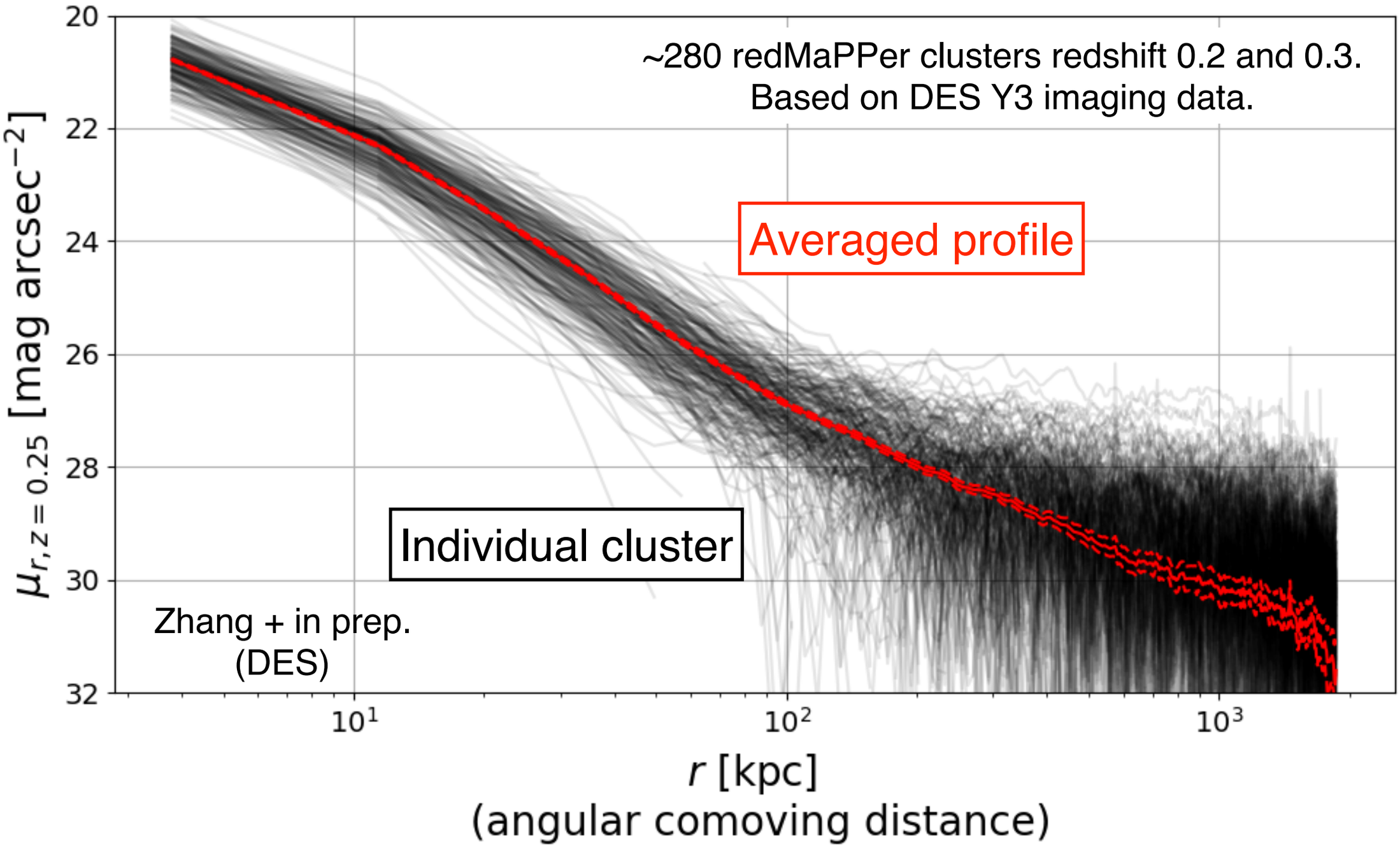
Image of individual cluster





Based on DES Y3 data

Stacking enables ICL detection out to ~1 Mpc from the cluster center and at a surface brightness level of 30 mag/arcsec^2.

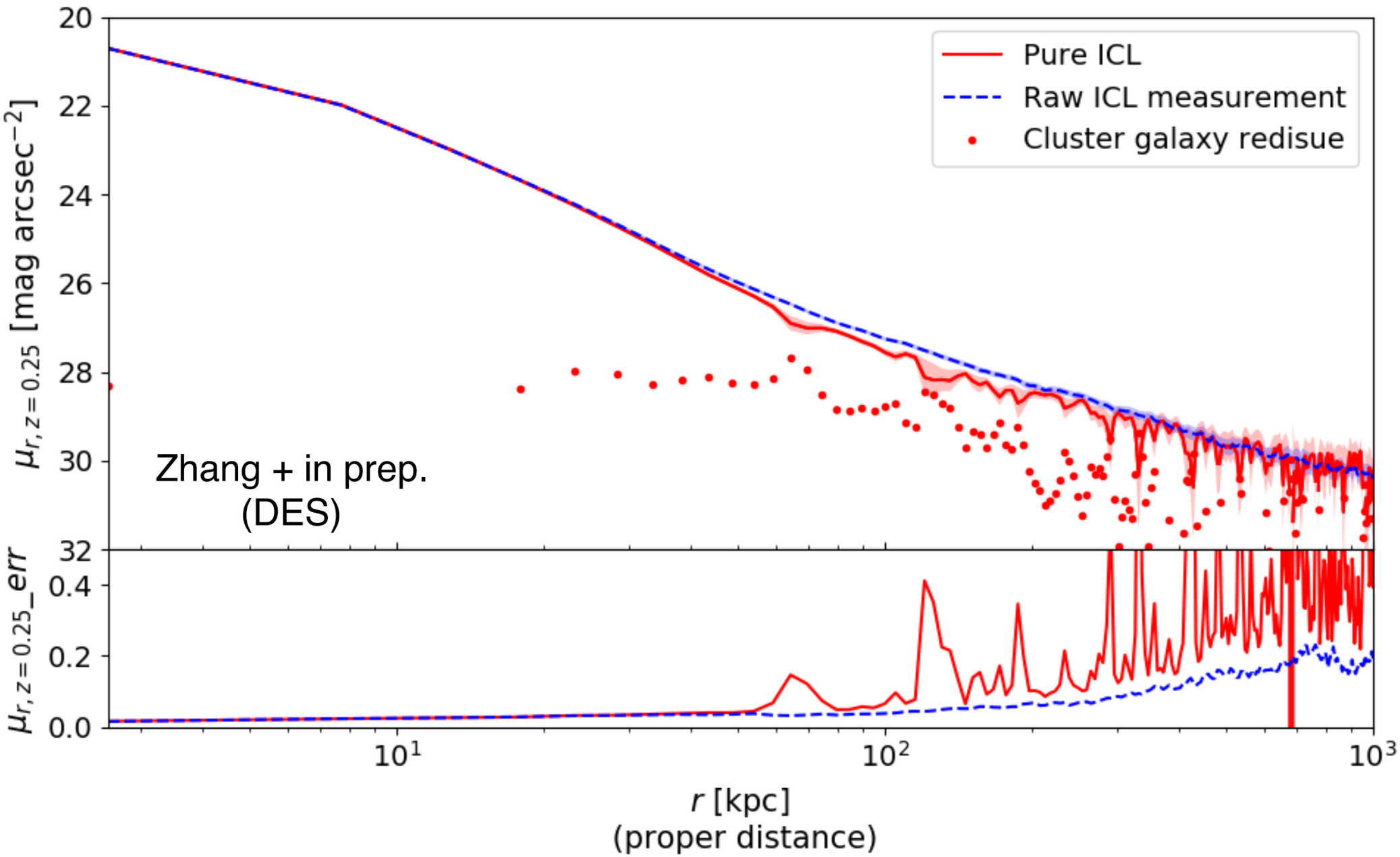


ICL detected till the edge of this image!

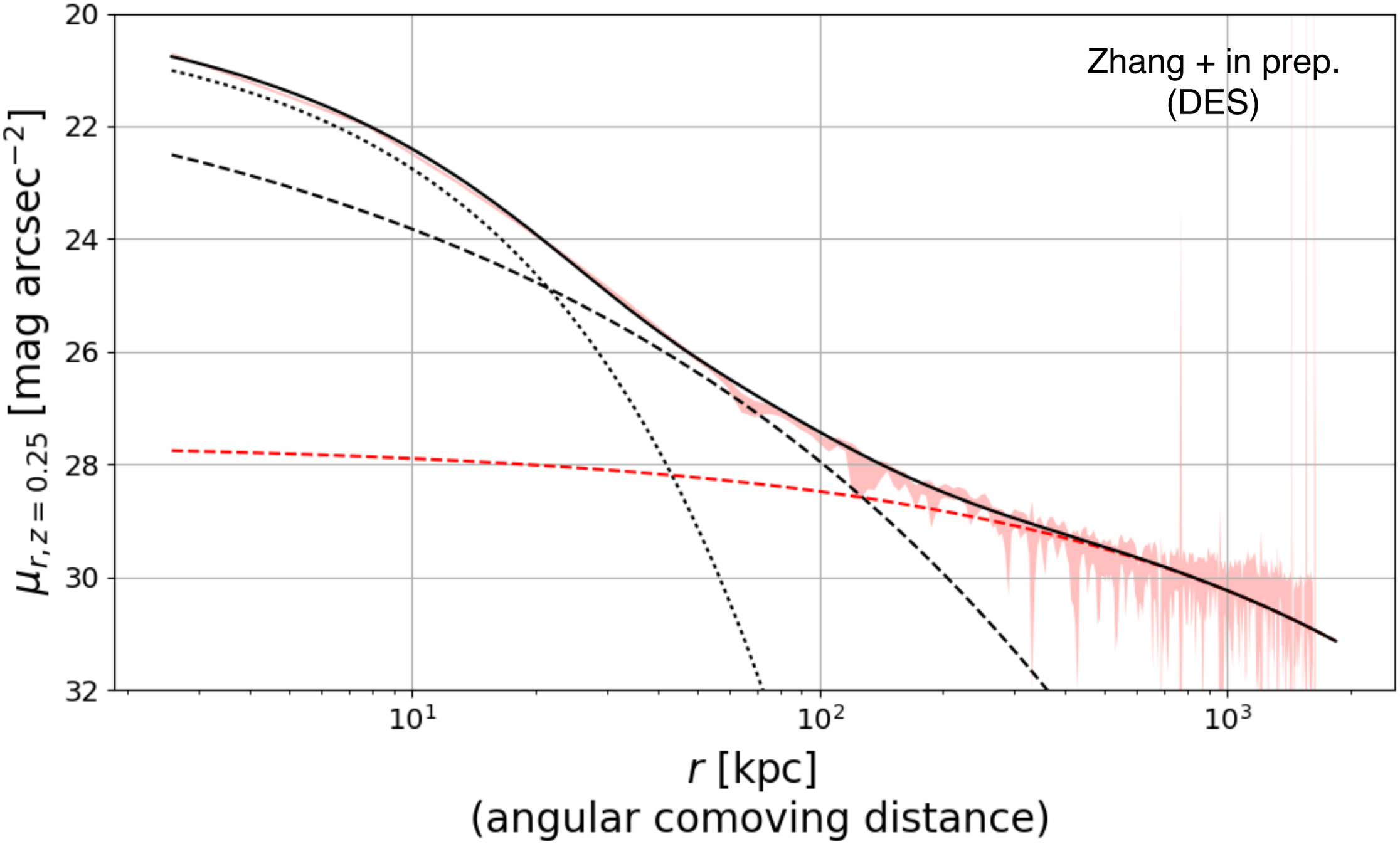
DES collaboration, E. Suchyta, P. Melchior (OSU, CCAPP)

300 kpc

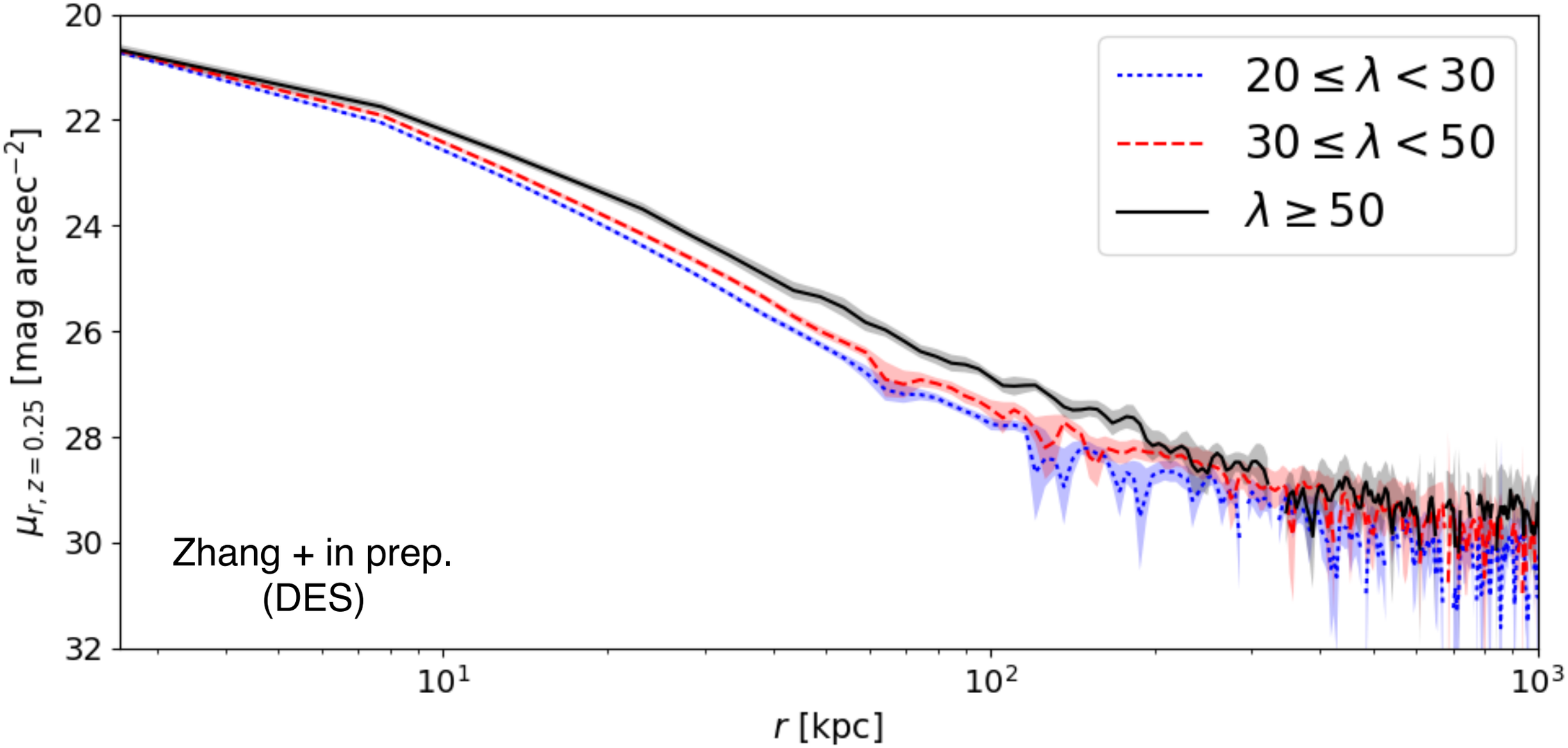
Residue light from cluster member galaxies makes up a small component (~10%) of the diffuse light detection.



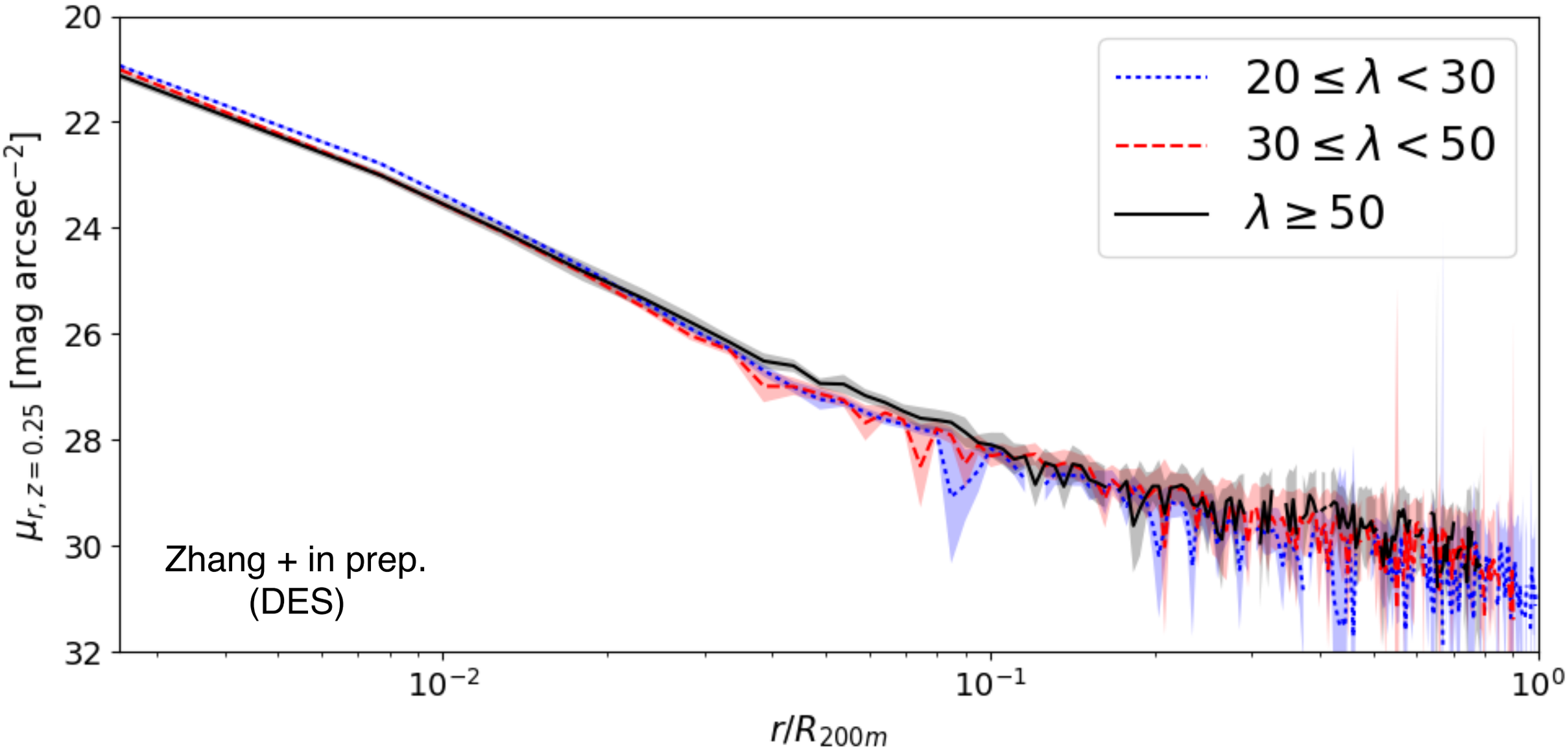
ICL needs to be modeled by a composite of several Sersic models.



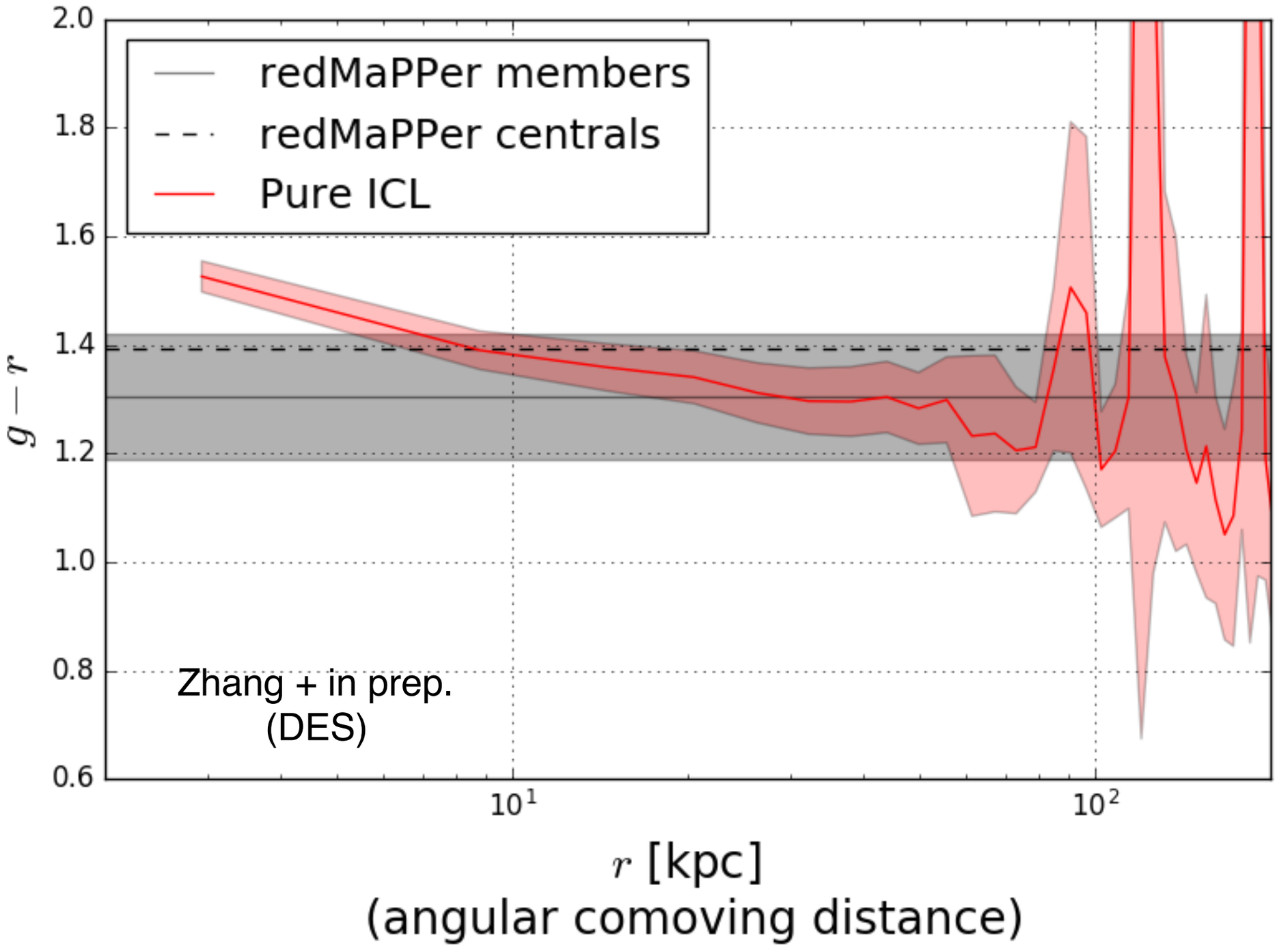
ICL is more abundant in richer clusters,



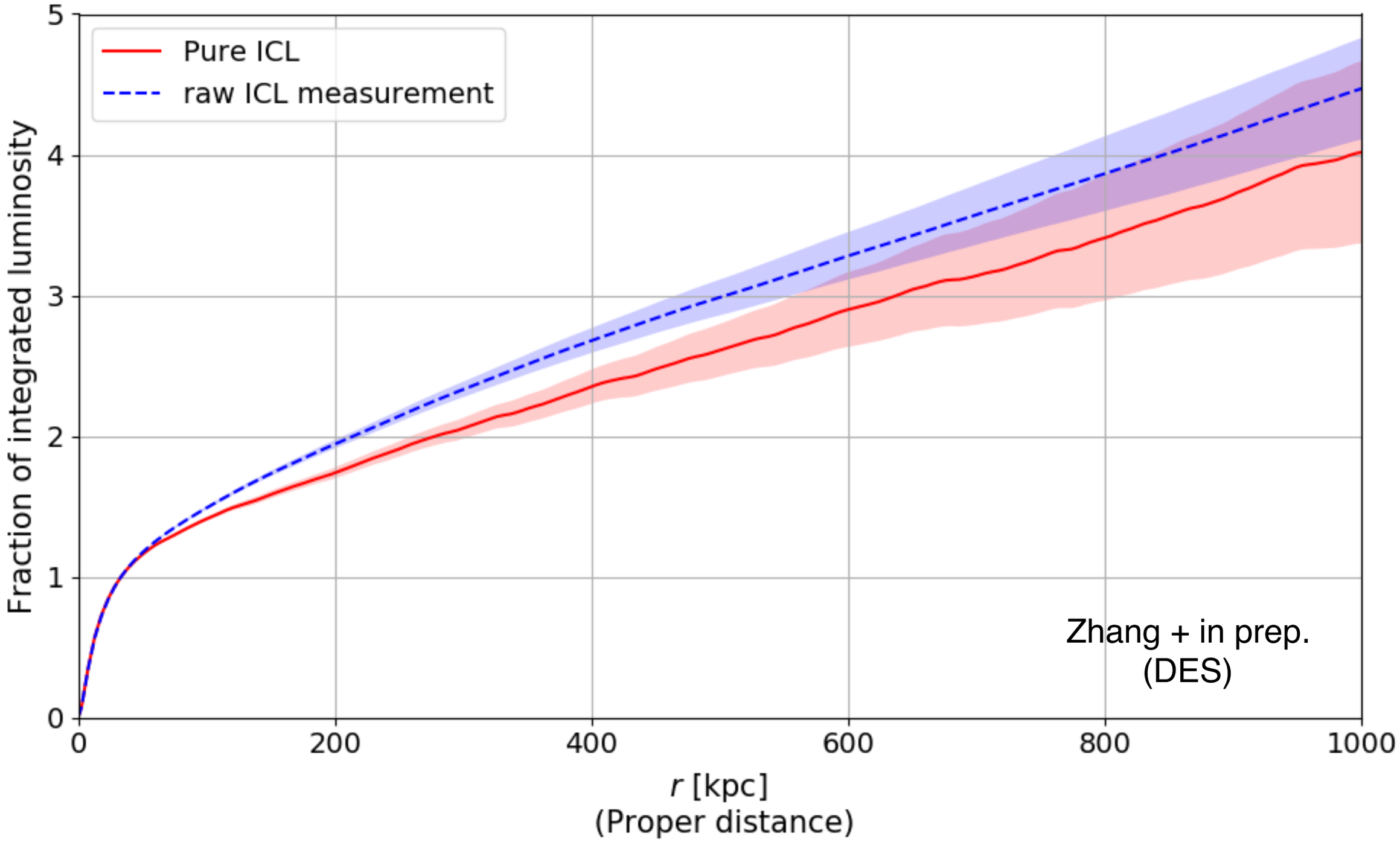
ICL is more abundant in richer clusters,
but that's probably just "self-similararity".



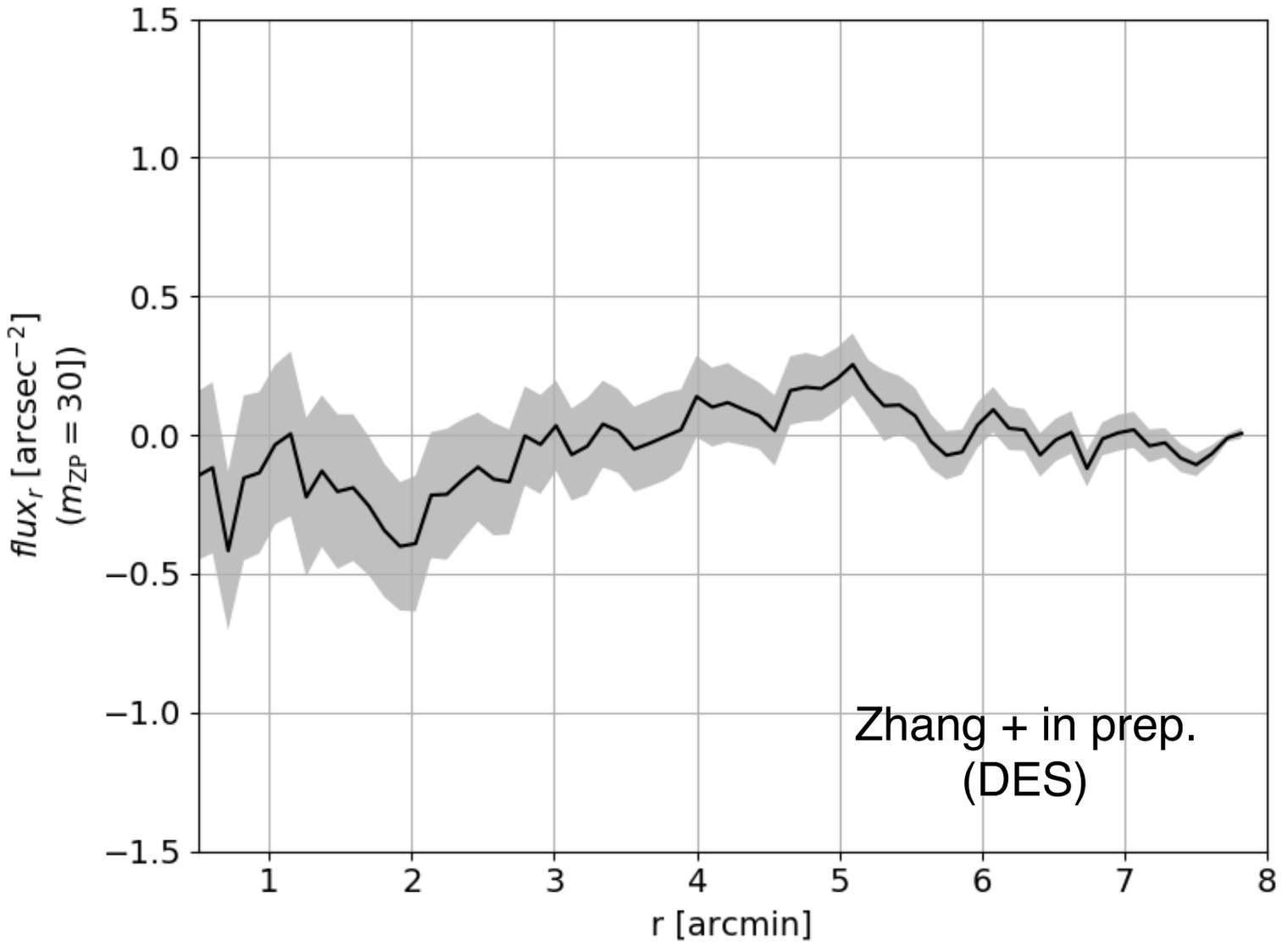
The color of ICL is bluer than that of the CG and consistent with the rest of the cluster galaxies.



Yes, ICL is an important component of galaxy cluster.

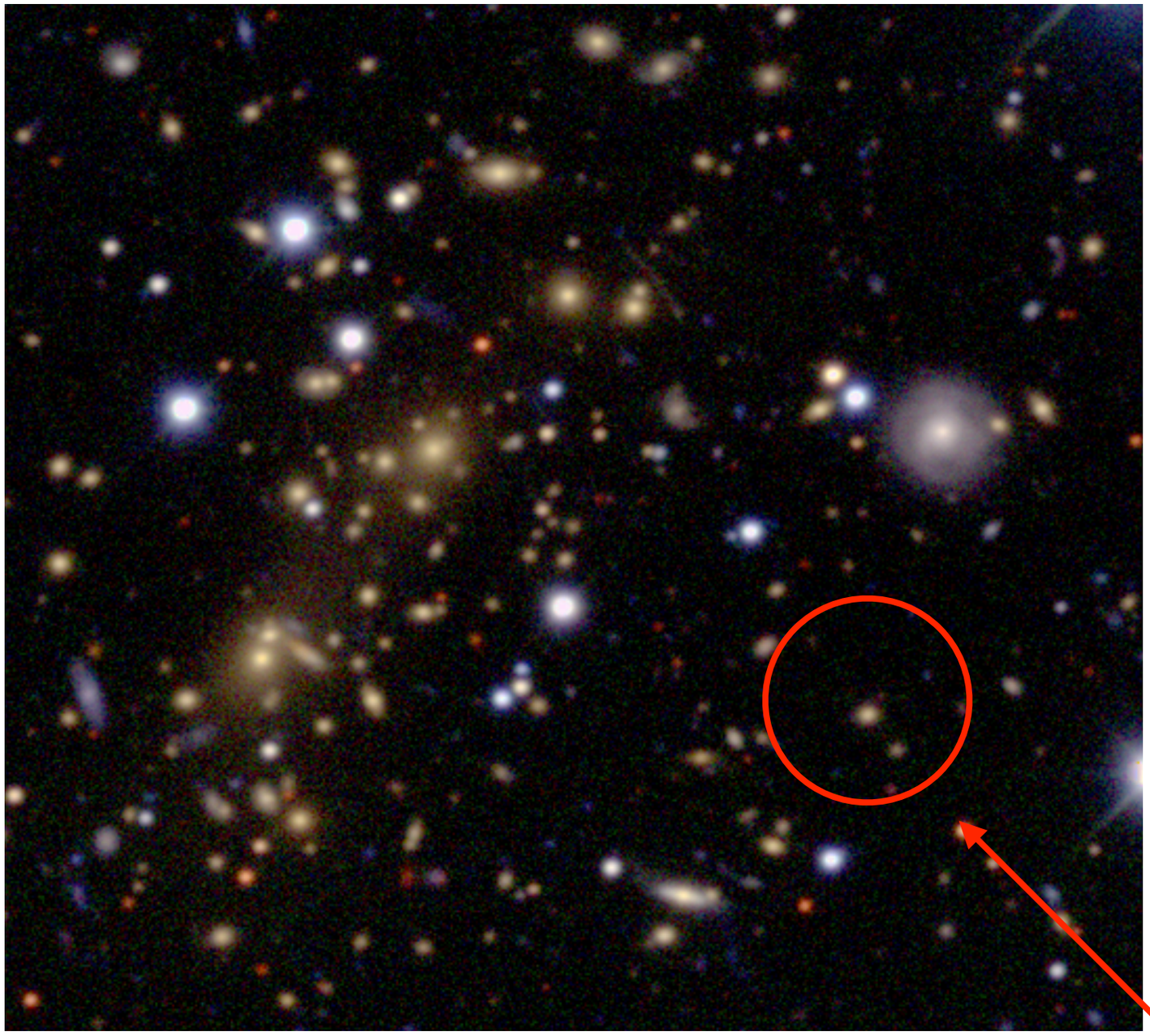


We can stack more than just clusters…



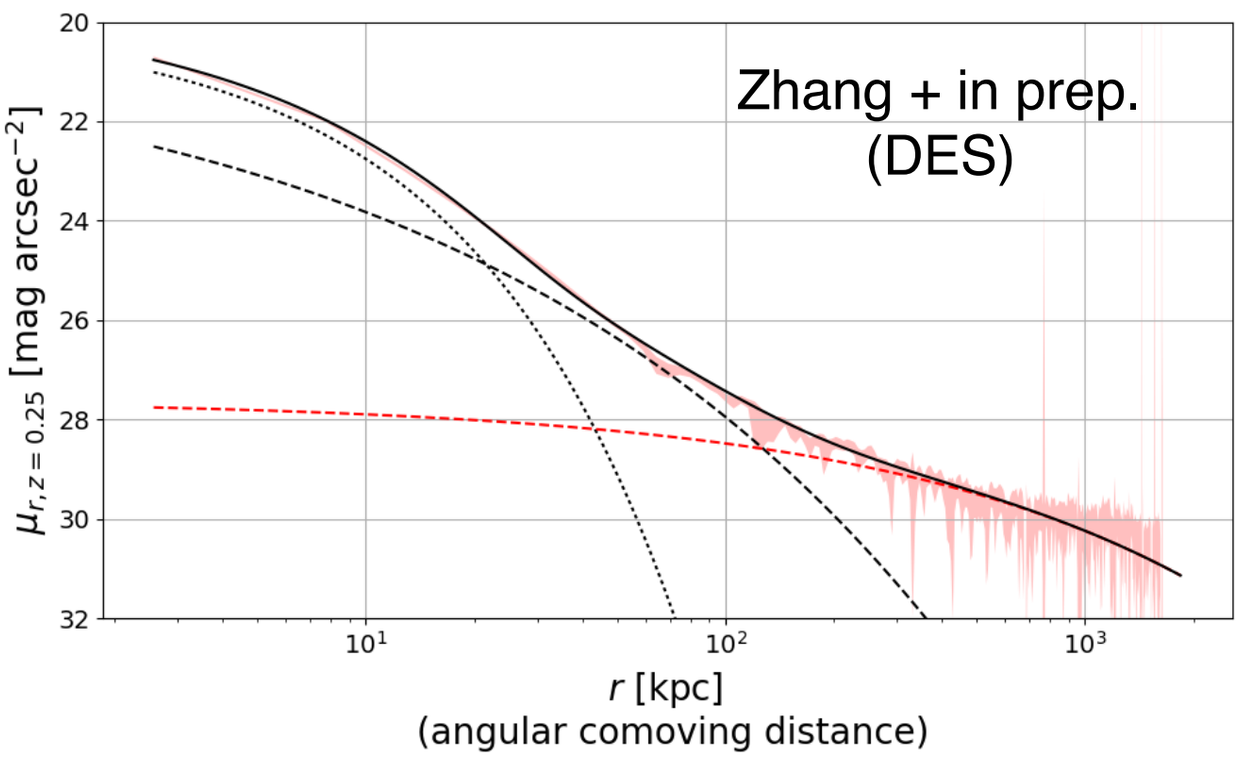
Stacking random points shows that the measurements are (relatively) bias-free.

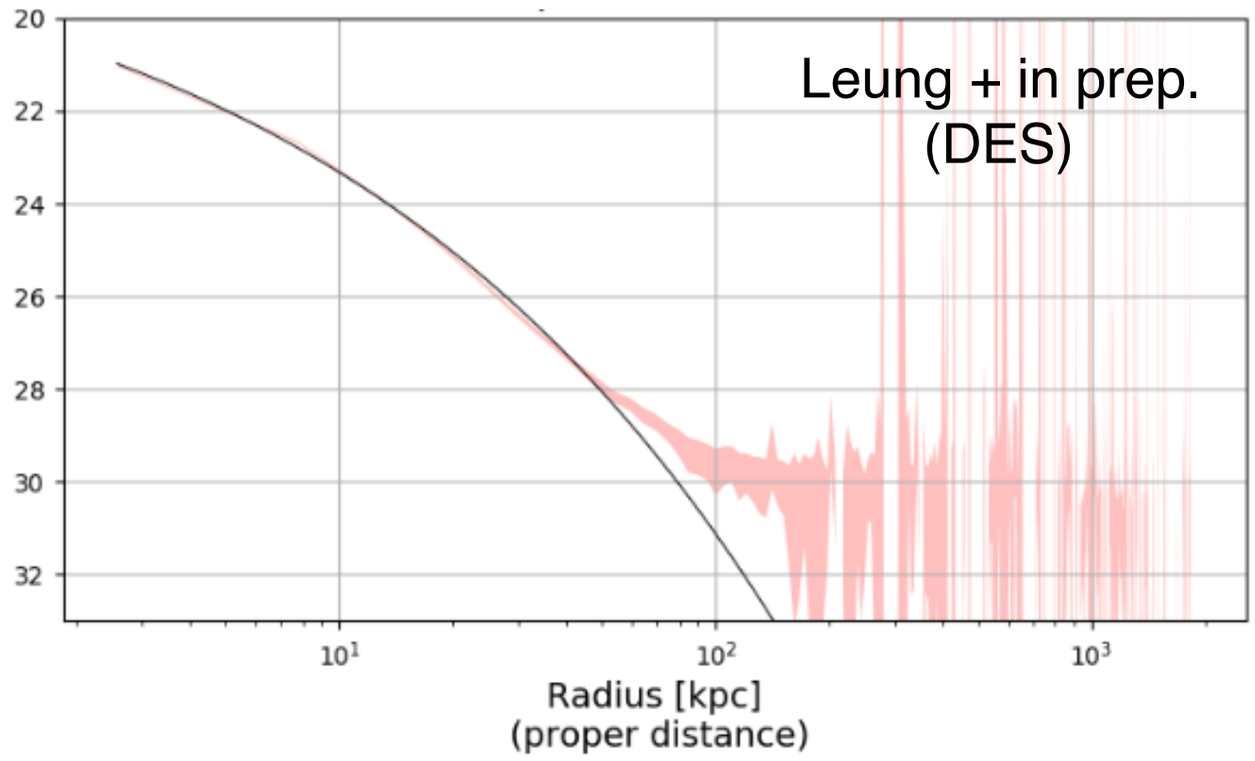
We can stack more than just clusters…



It could be interesting to compare ICL to **luminous red galaxies**.

We can stack more than just clusters…



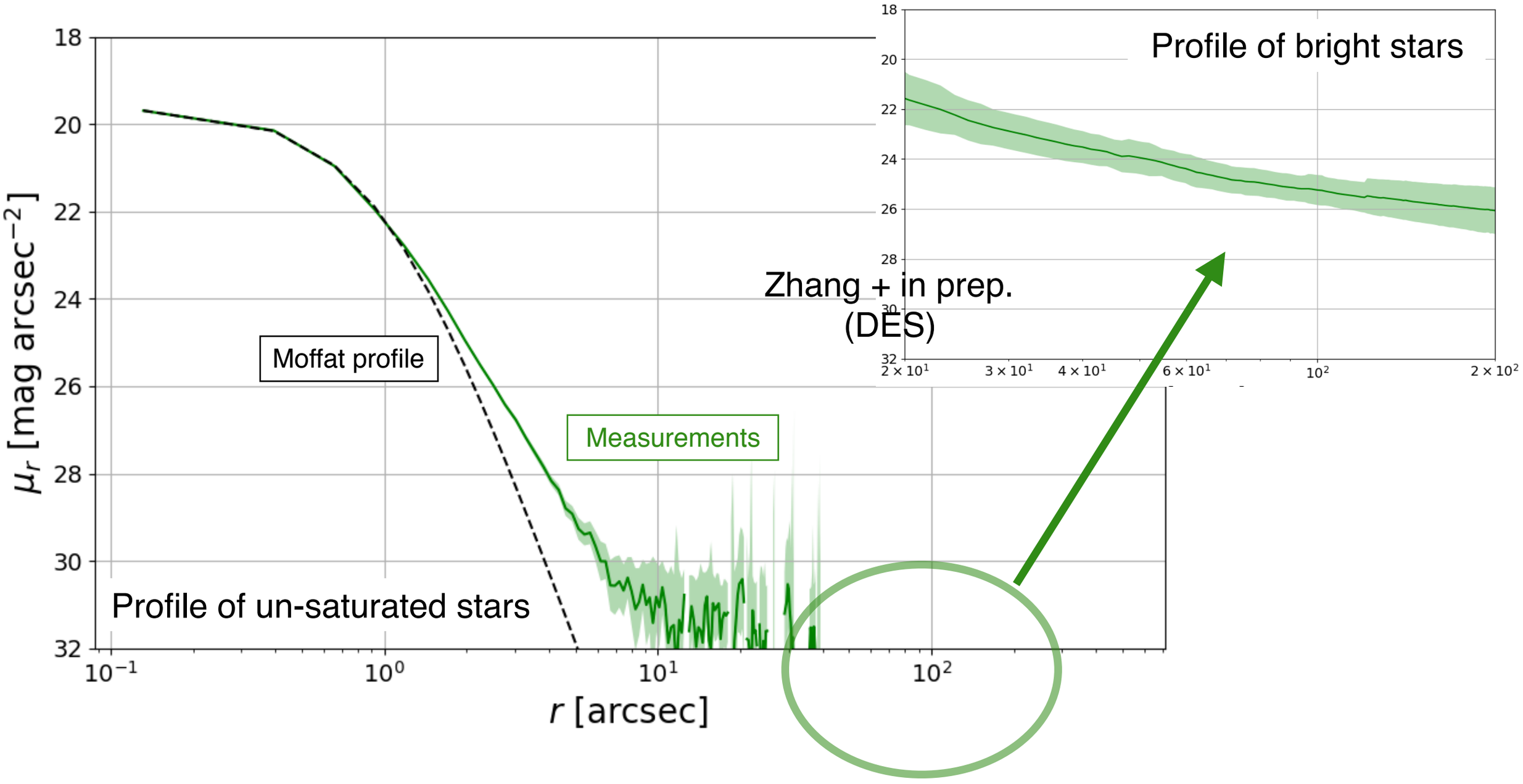


redMaPPer ICL
(~280 clusters)

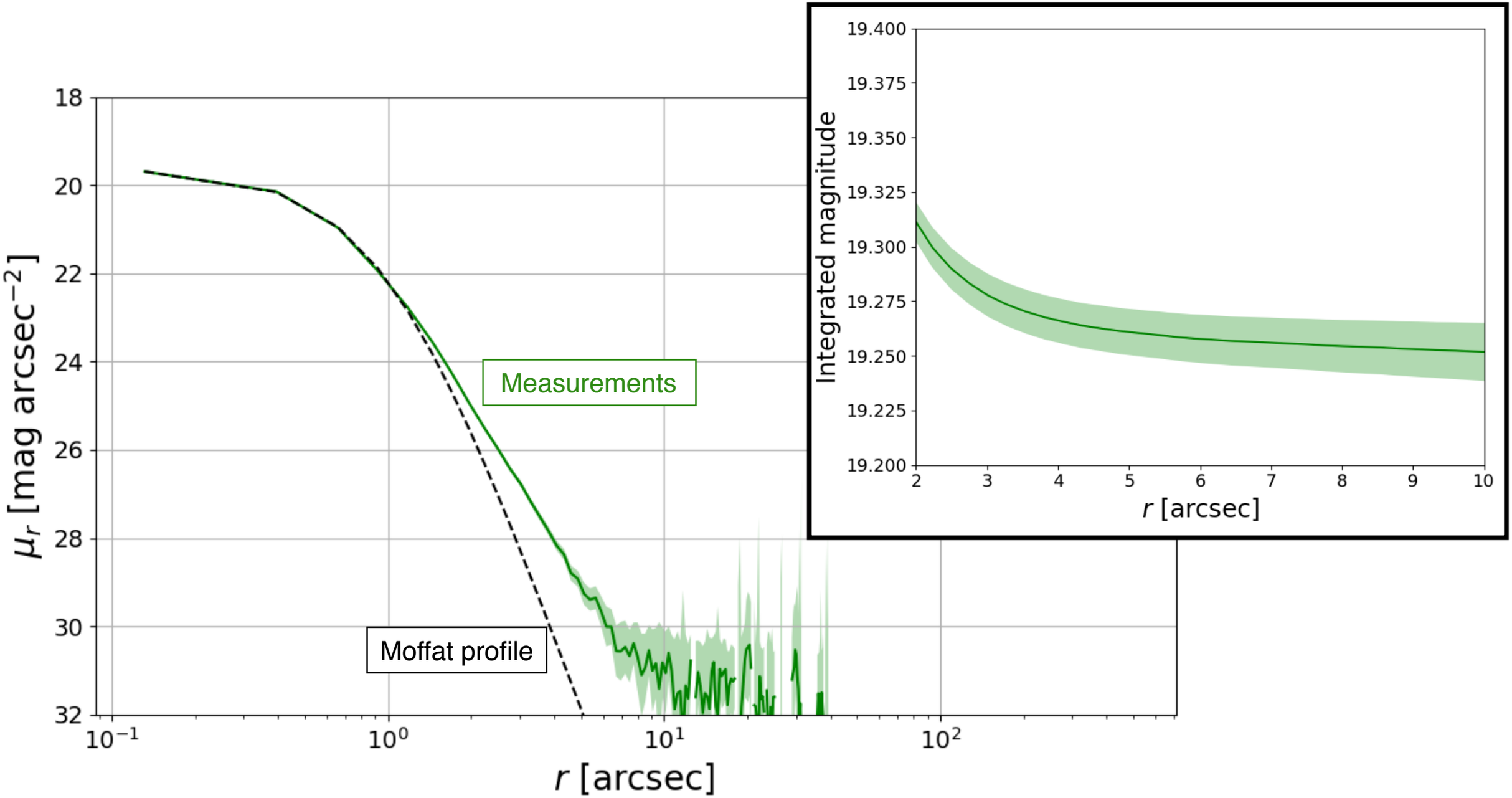
redMagic LRGs
(~650 LRGs)

LRGs appear to be much less extended than ICL (redshift ~ 0.25).

We can stack more than just clusters…



Stacking stars shows that DECam PSF has extended wings.



Stacking stars shows that DECam PSF has extended wings.

DECam at the Low Surface Brightness Limit
Detection of Diffuse Light in Galaxies and Galaxy Clusters

Summary:

DECam allows studying low surface brightness light
with a stacking technique.

We have detected diffuse light in galaxies and clusters
to 30 mag/arcsec^2.

Three DES papers in preparation:

Zhang + (ICL profile)

Gruen + (ICL photo-z bias on lensing)

Leung + (LRG light profile)