Reconstructing the formation of massive (quiescent) galaxies from their SHARDS

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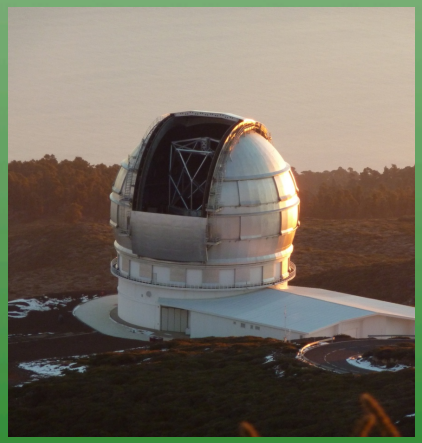
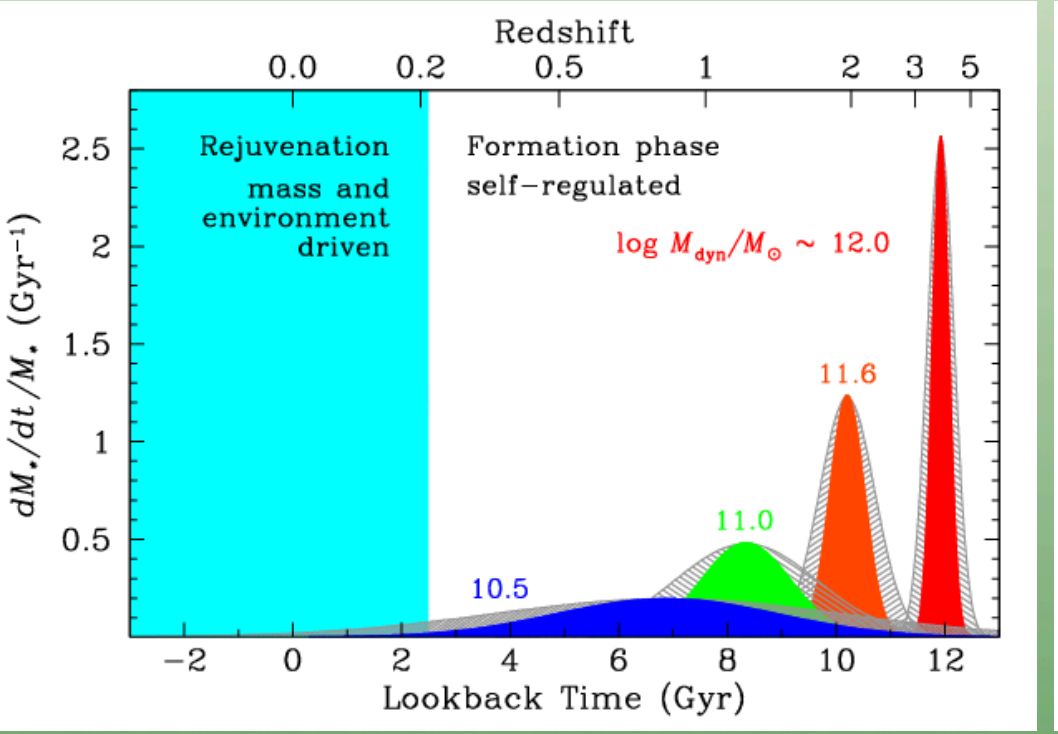


SHARDS

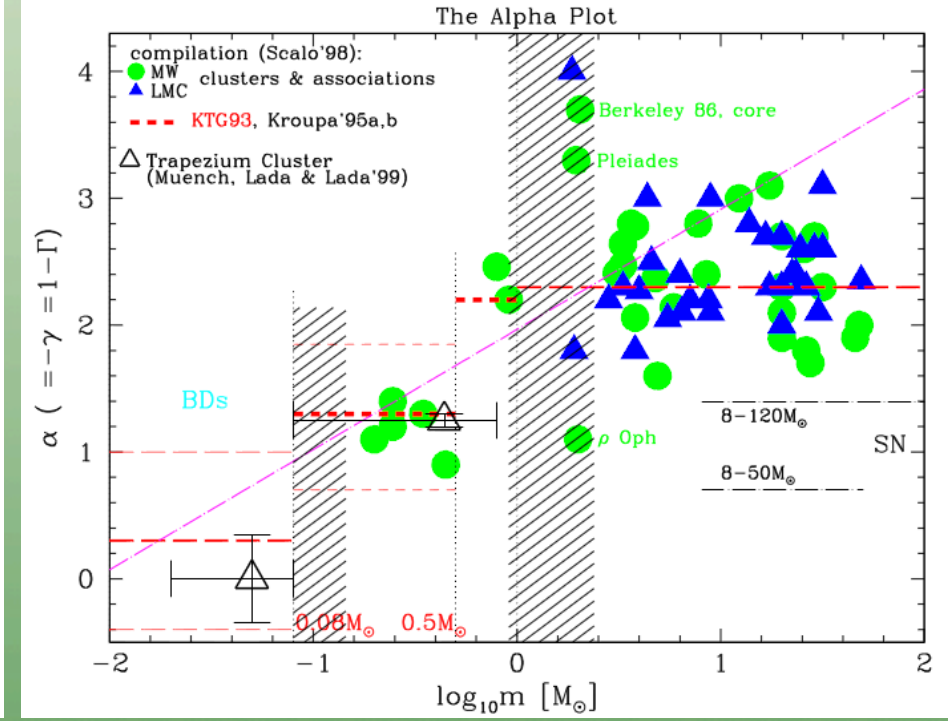
CONSOLIDER - INGENIO

GTC

Are these plots true?



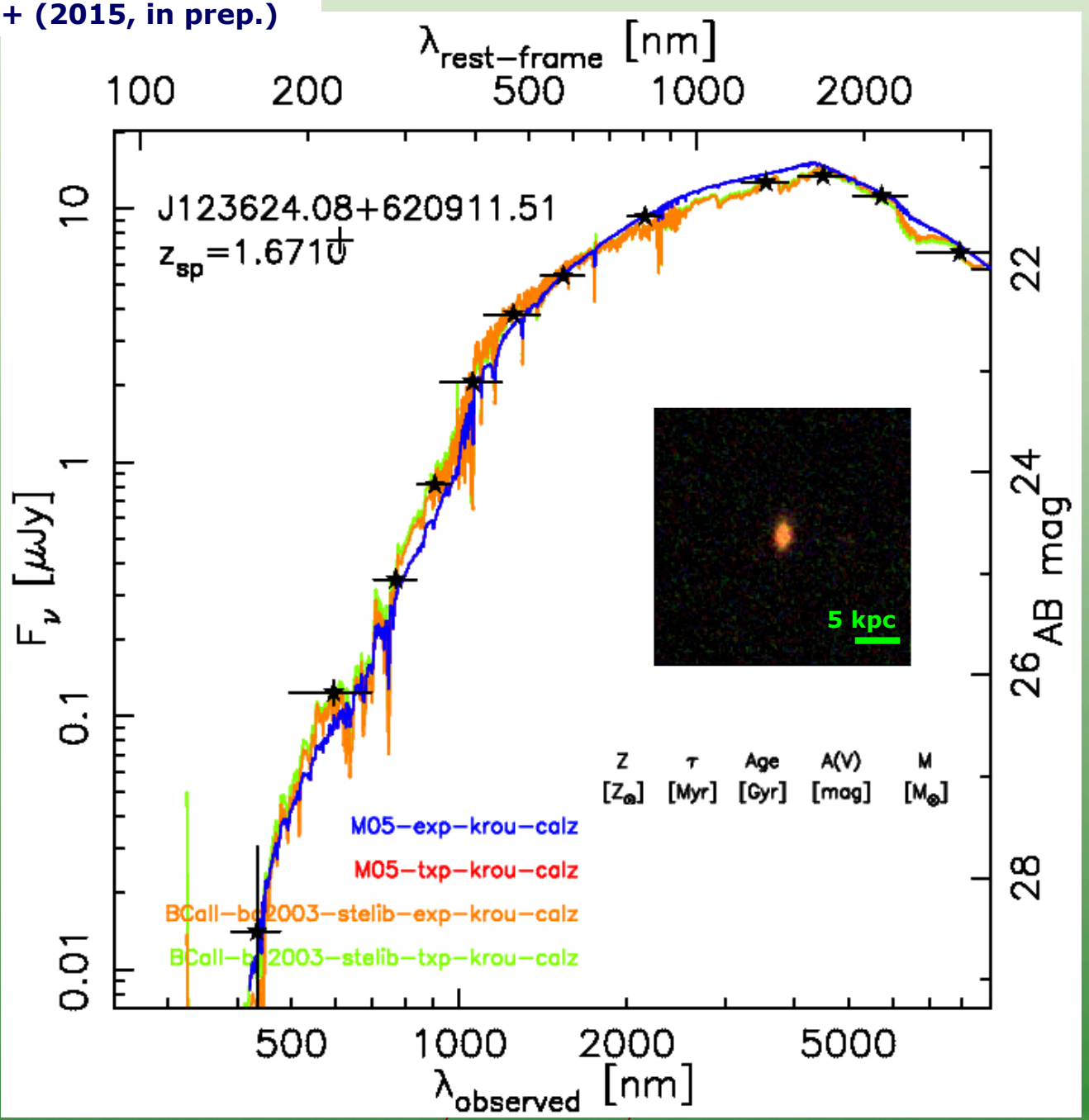
Thomas+ (2005)



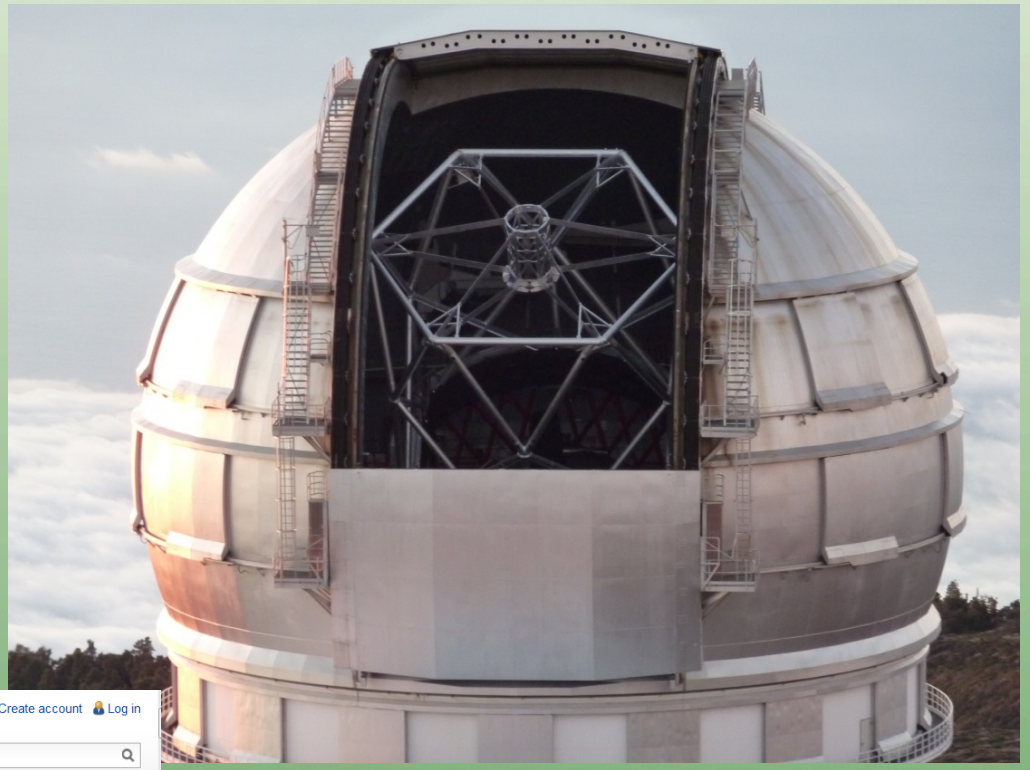
Kroupa (2001)

Getting SFHs, a very degenerated problem

Pérez-González+ (2015, in prep.)



What kind of data do we need to get reliable SFHs?



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List of largest optical reflecting telescopes

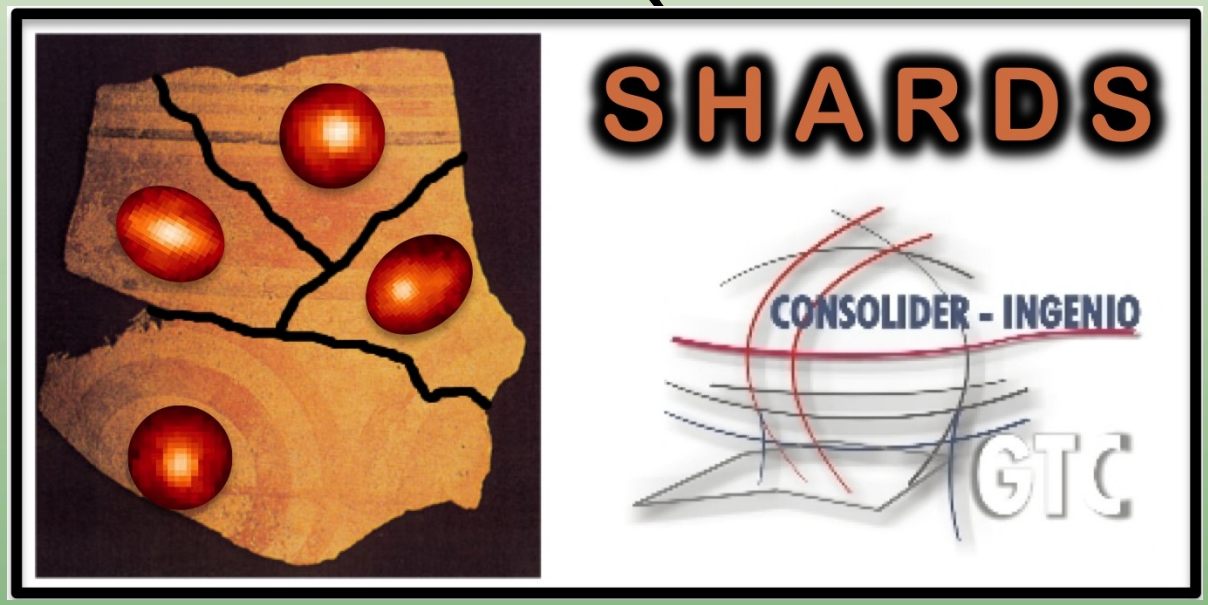
From Wikipedia, the free encyclopedia

Name	Image	Effective aperture m	Aper. in	Mirror type	Nationality / Sponsors	Site	Built
Gran Telescopio Canarias (GTC)		10.4 m	409″	Segmented, 36	Spain (90%), Mexico, USA	Roque de los Muchachos Obs., Canary Islands, Spain	2006/9
Keck 1		10 m	394″	Segmented, 36	USA	Mauna Kea Observatories, Hawaii, USA	1993
Keck 2		10 m	394″	Segmented, 36	USA	Mauna Kea Observatories, Hawaii, USA	1996
Southern African Large Telescope (SALT) [1] (11 m × 9.8 m mirror)		9.2 m	362″	Segmented, 91	South Africa, USA, UK, Germany, Poland, New Zealand	South African Astronomical Obs., Northern Cape, South	2005

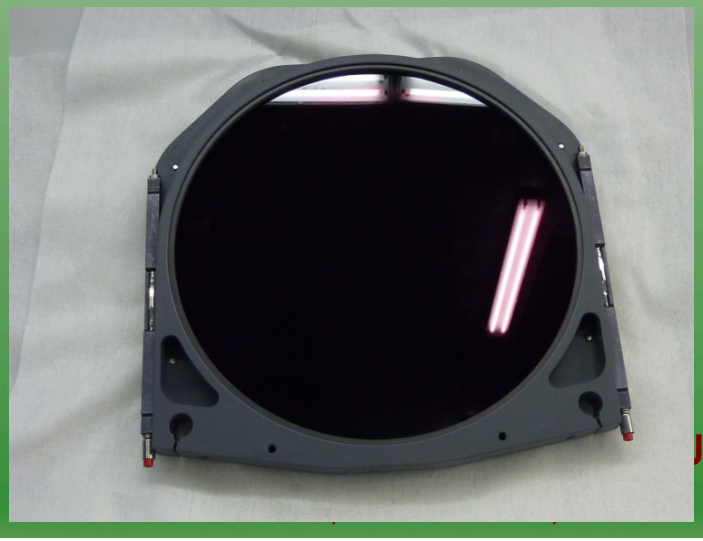
of the Universe

, 2015

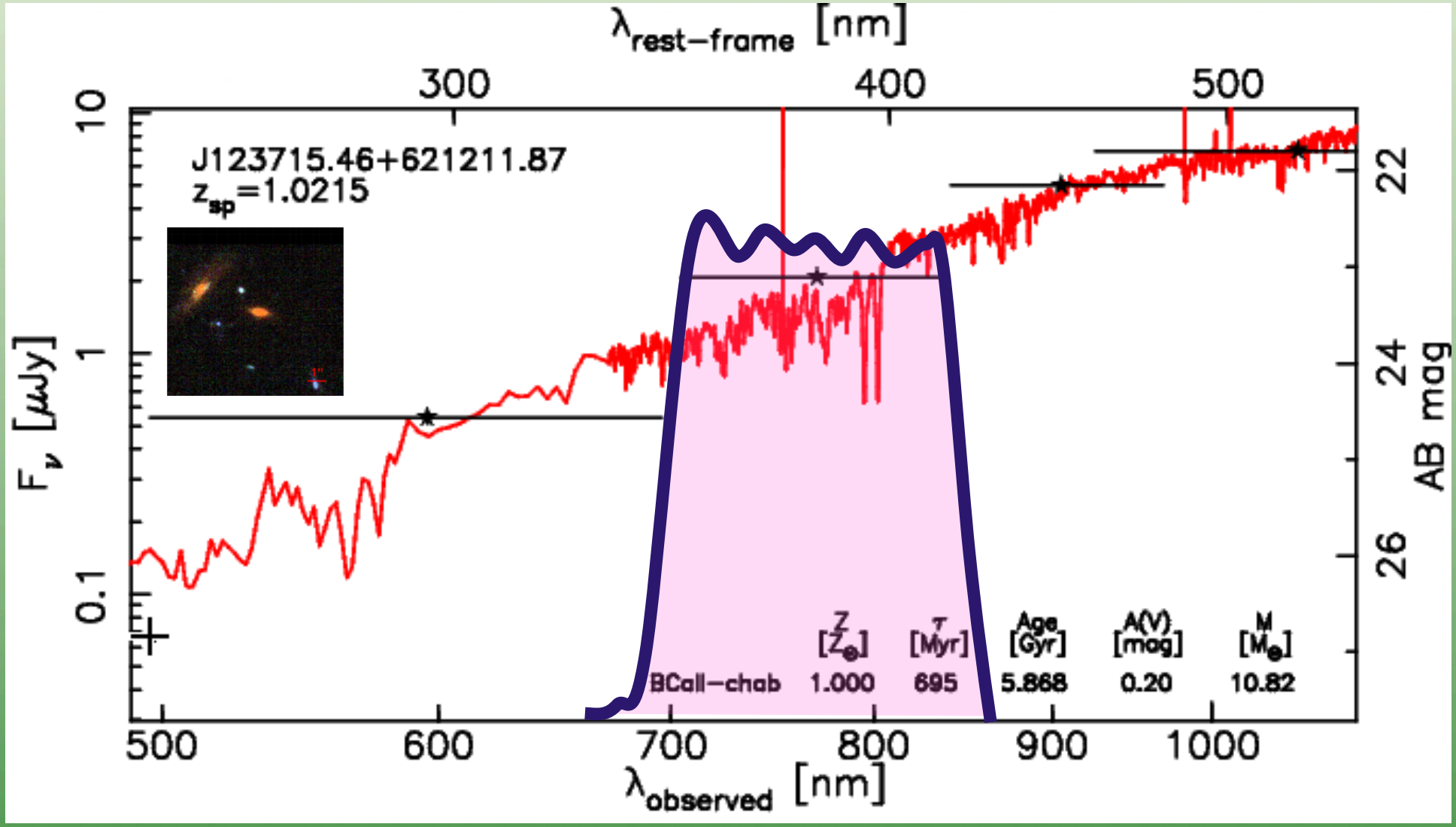
SHARDS: Survey for High-z Absorption Red and Dead Sources (in GOODS-N field)



http://guaix.fis.ucm.es/~pgperez/SHARDS



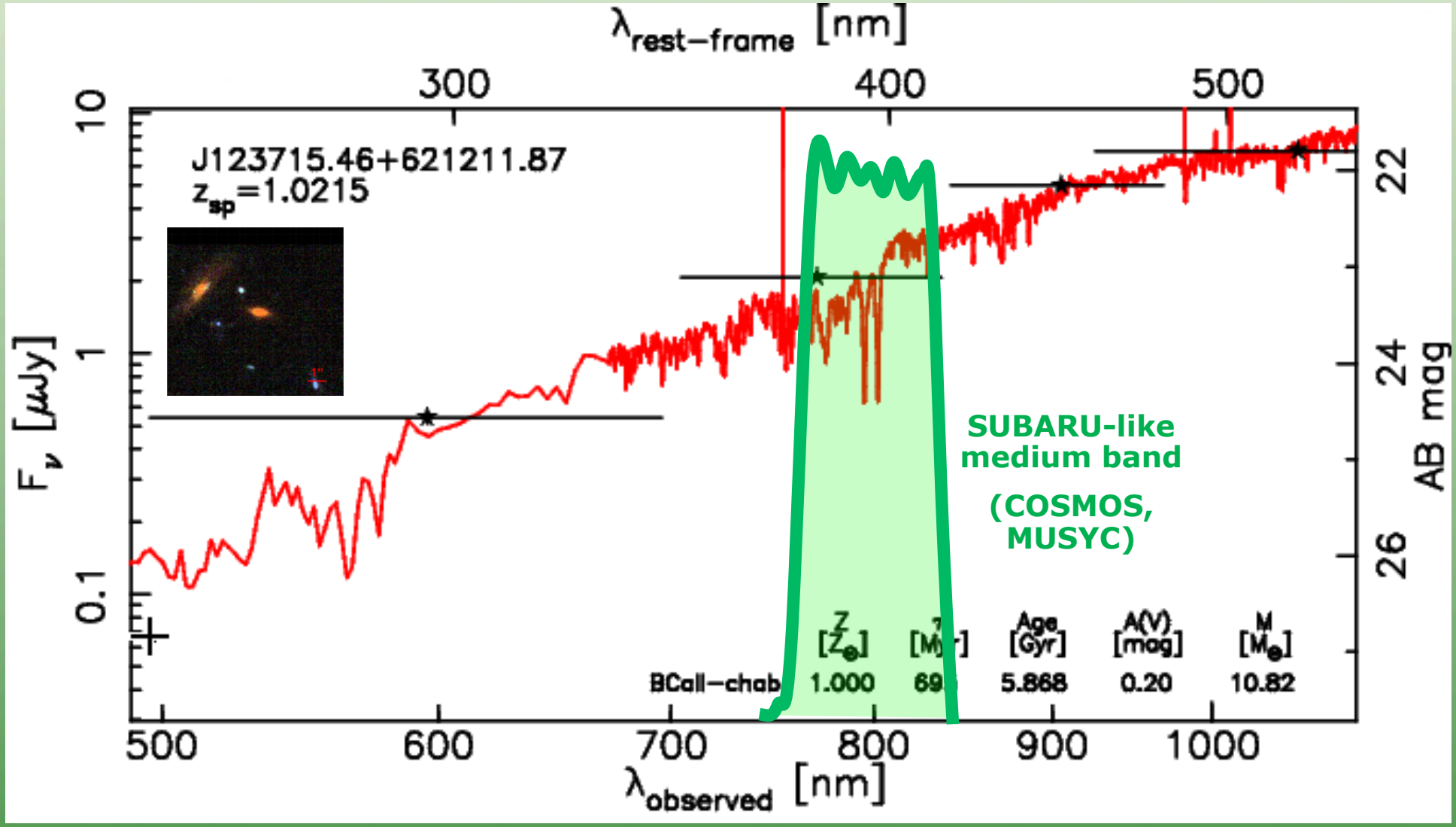
SHARDS: SFHs based on absorption indices



Pérez-González et al. (2013)

Magnitudes of $M \gtrsim 10^{10} M_{\odot}$ galaxies @ z=1-3 > (27,26,25)

SHARDS: SFHs based on absorption indices



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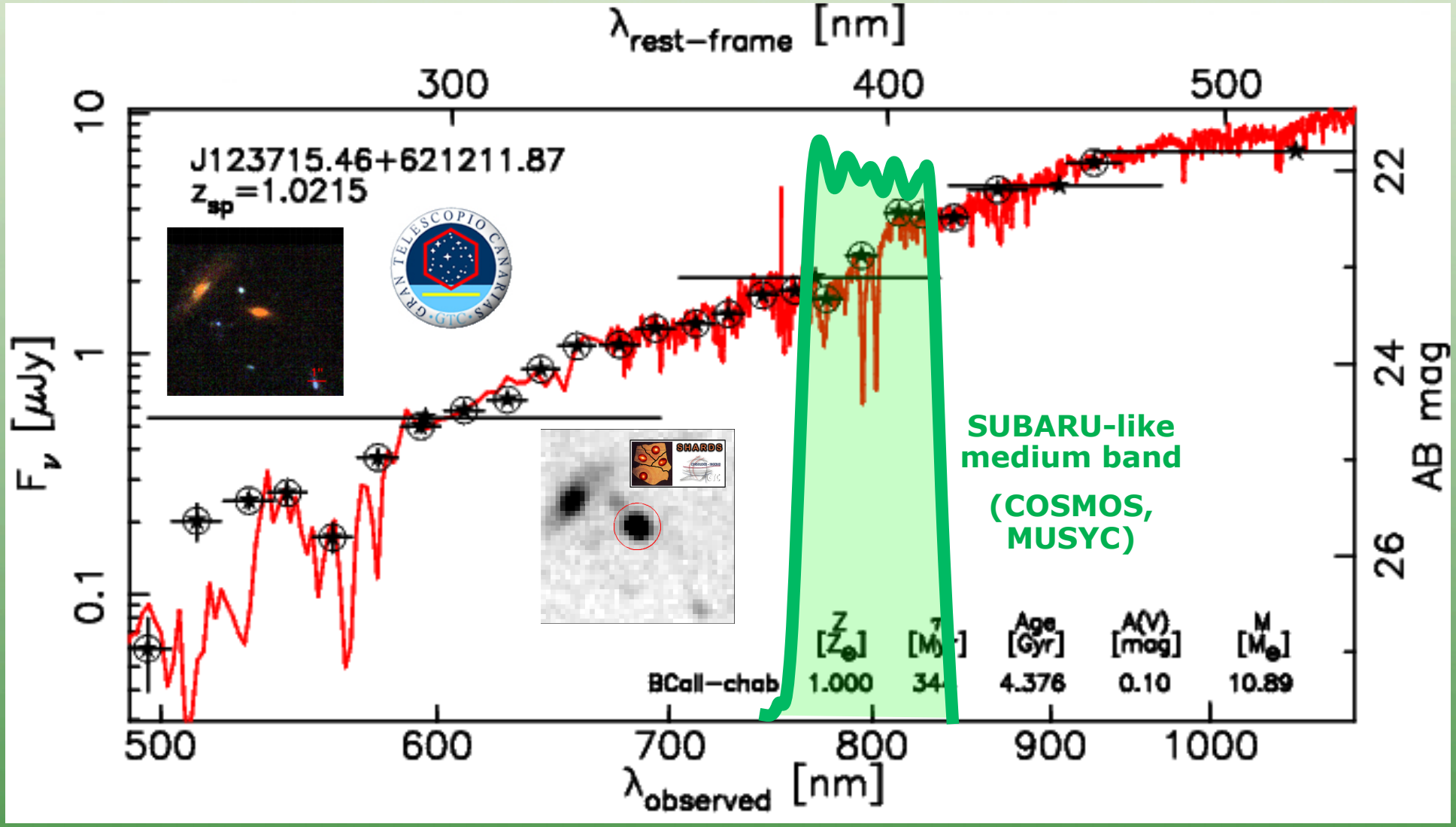

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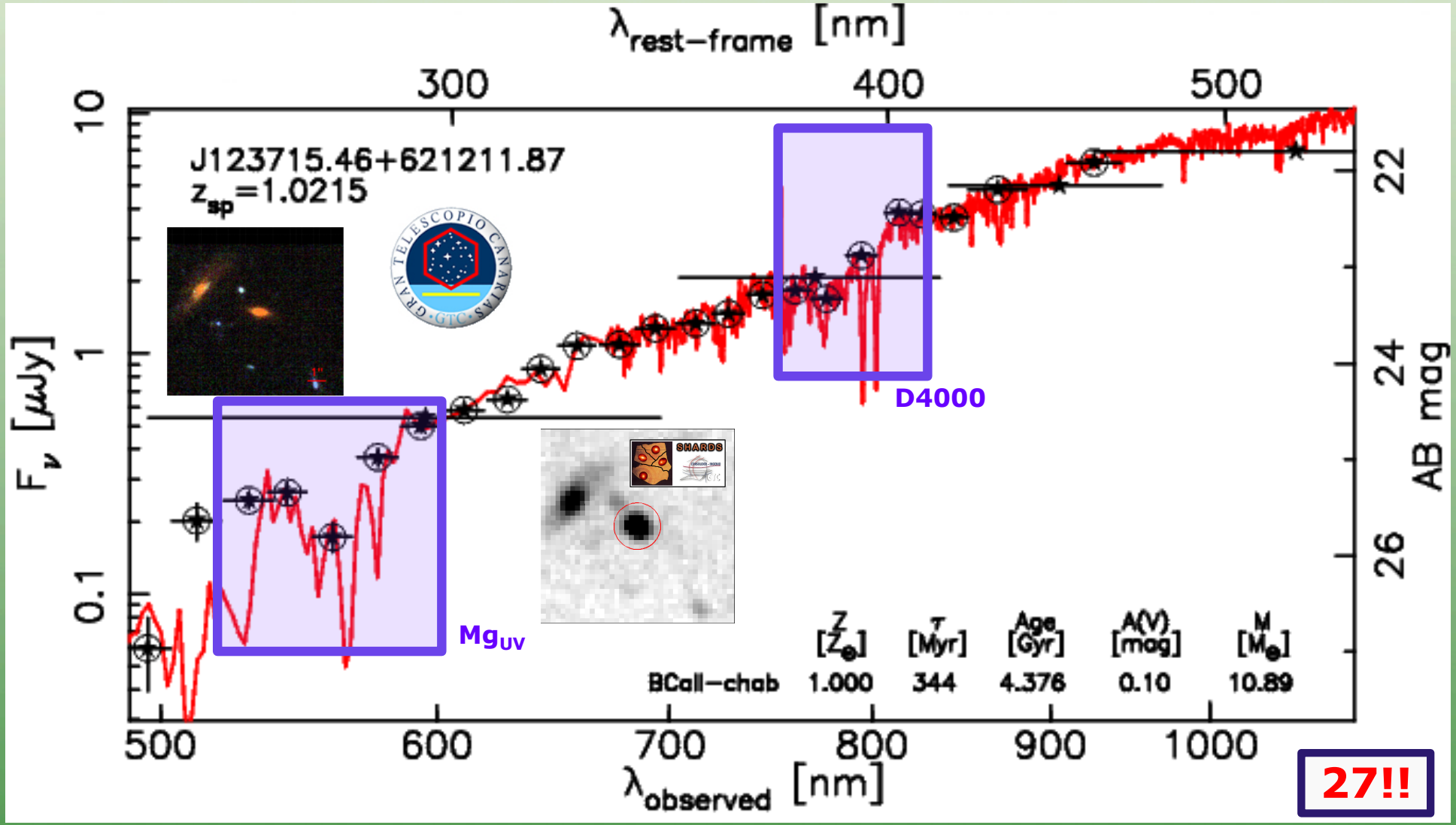


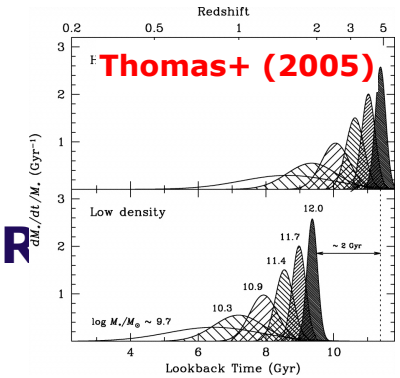
Pérez-González et al. (2013)

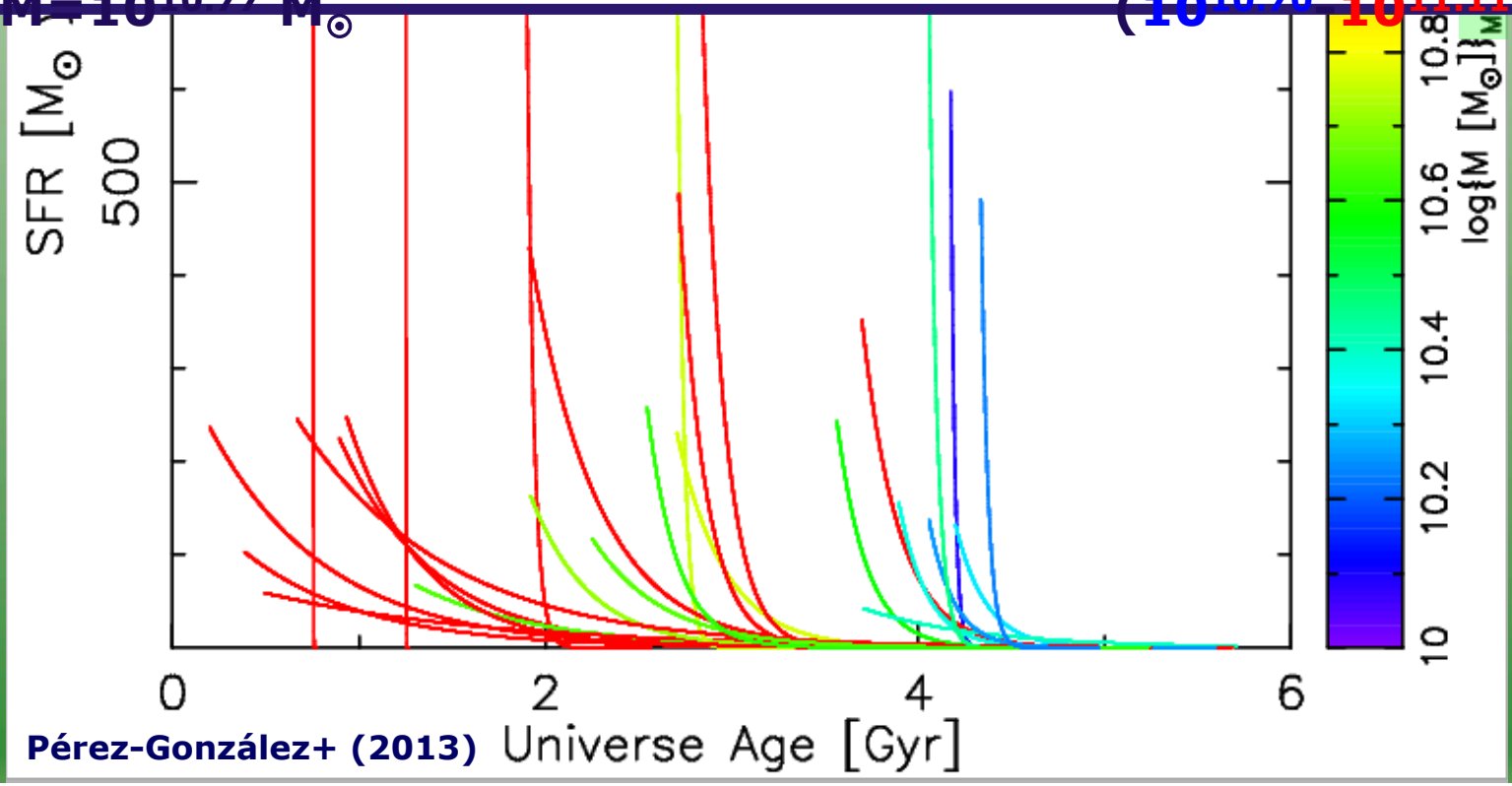
Magnitudes of $M \gtrsim 10^{10} M_{\odot}$ galaxies @ z=1-3 > (27,26,25)

SHARDS: downsizing in detail (at z~1)

Statistical properties of z>1 MQGs with spec-z (lighter-heavier):

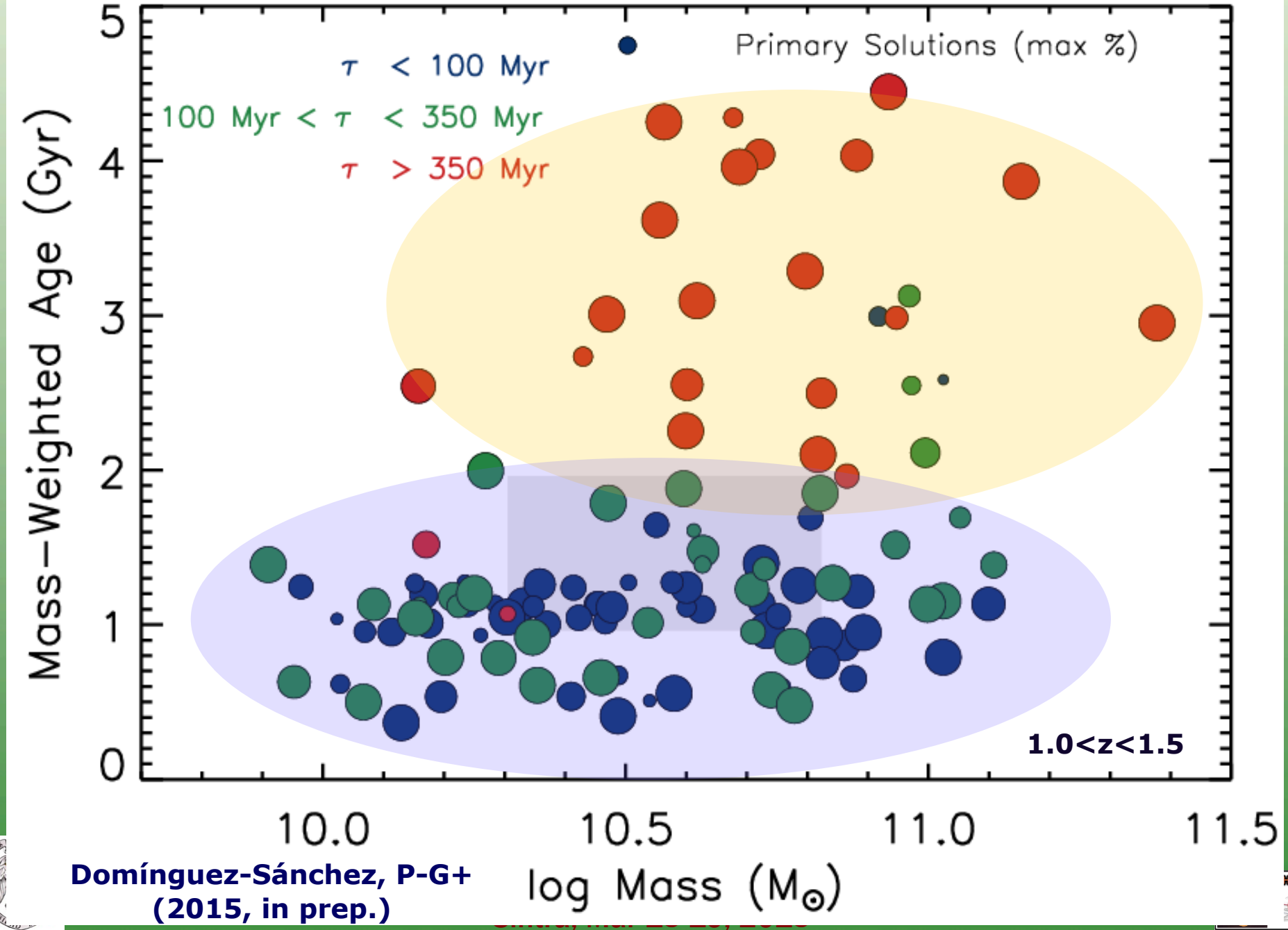
- **Age= 3.0 Gyr → z_f=4 (2.5-6)** — **(2.0-3.6)→z_f**
- **τ= 162 Myr** — **(158-375)**
- **SFR_{max}=250 $M_\odot$/yr (ULIR** — **(170-350)**
- **A(V)= 0.40 mag** — **(0.28-0.51)**
- **M=$10^{10.77}$ $M_\odot$** — **($10^{10.70}$-$10^{11.11}$)**





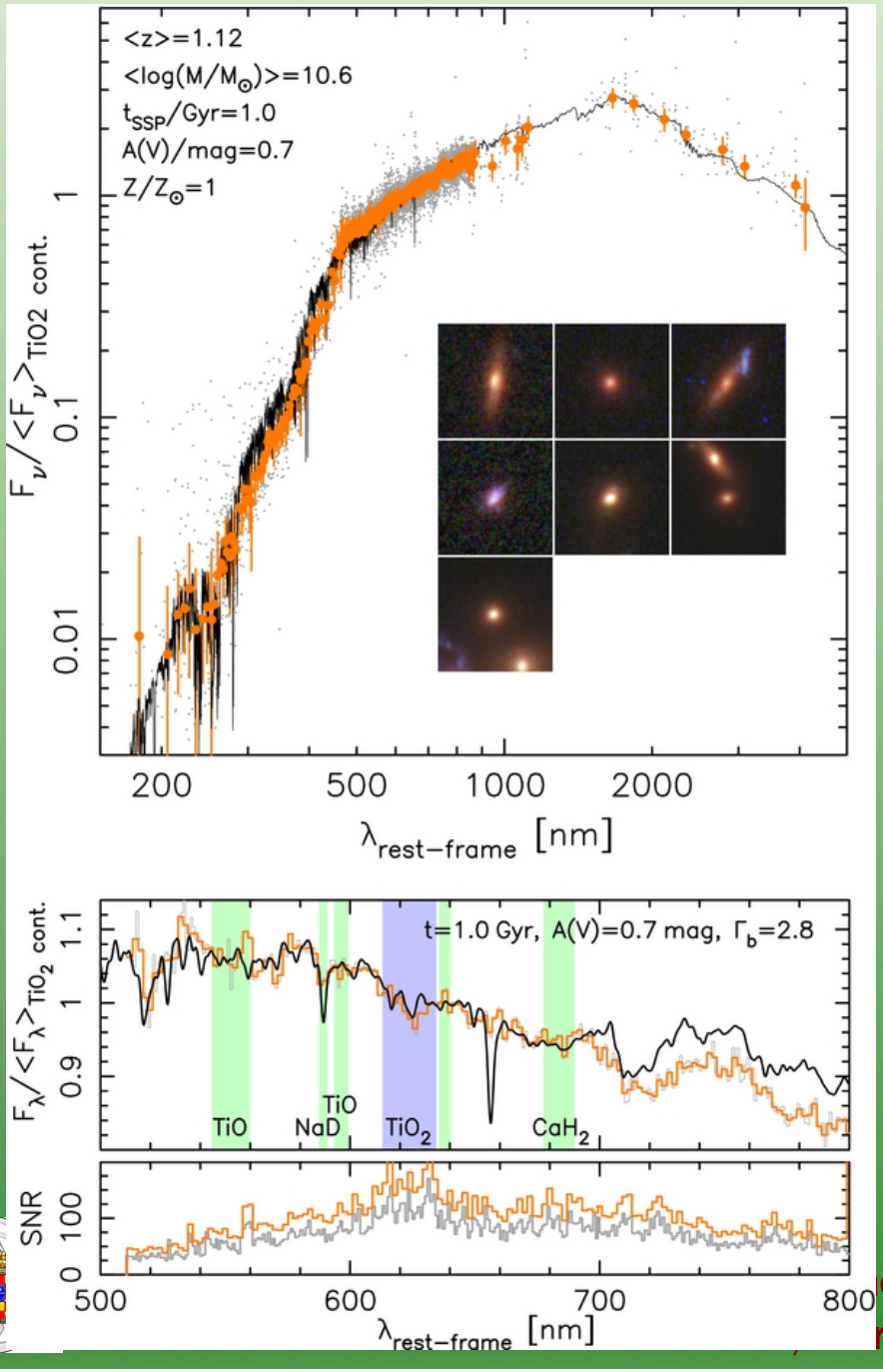
Pérez-González+ (2013)

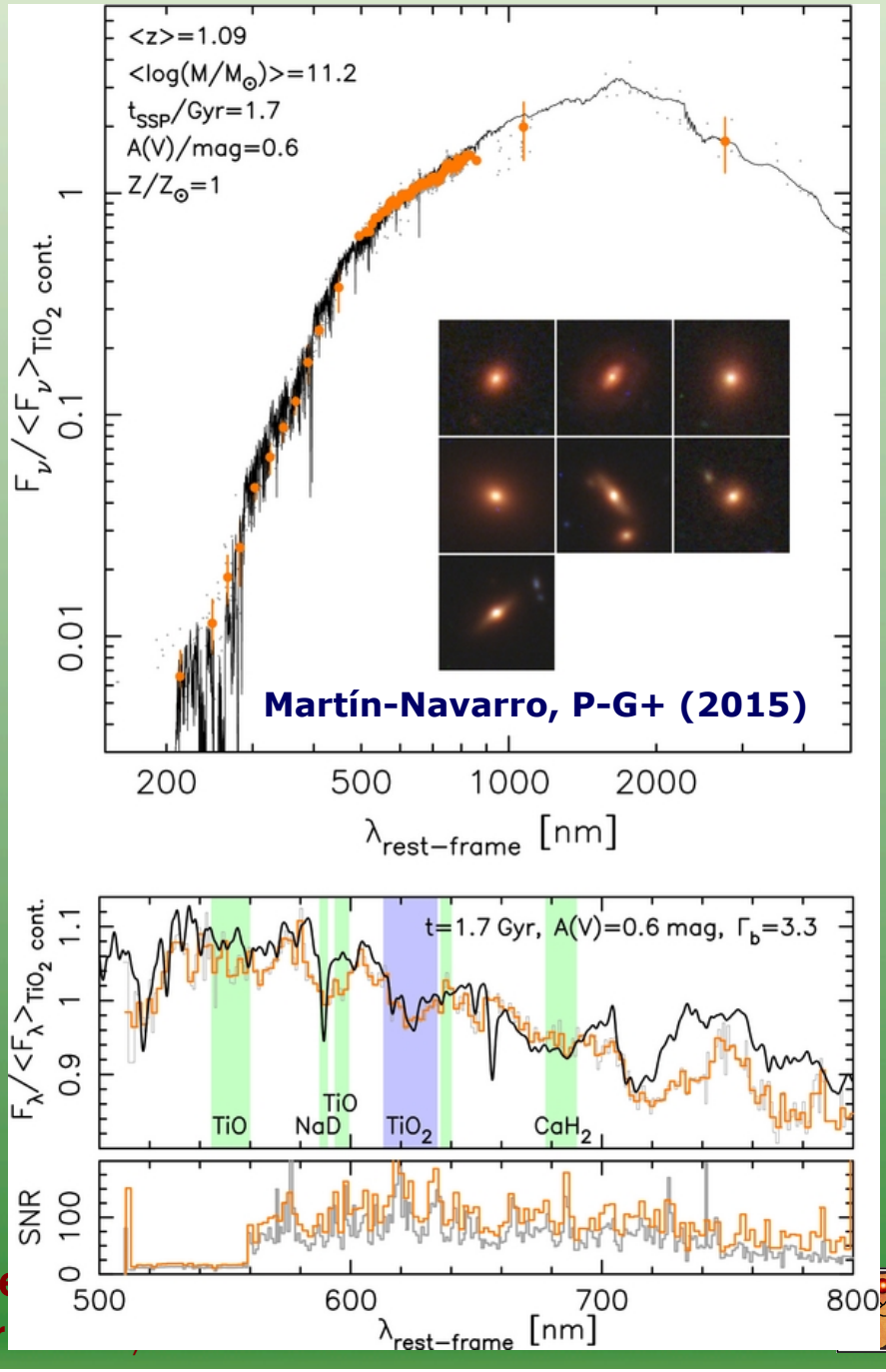
SHARDS+WFC3 grisms: SFHs of MQGs @z=1.0-3.0



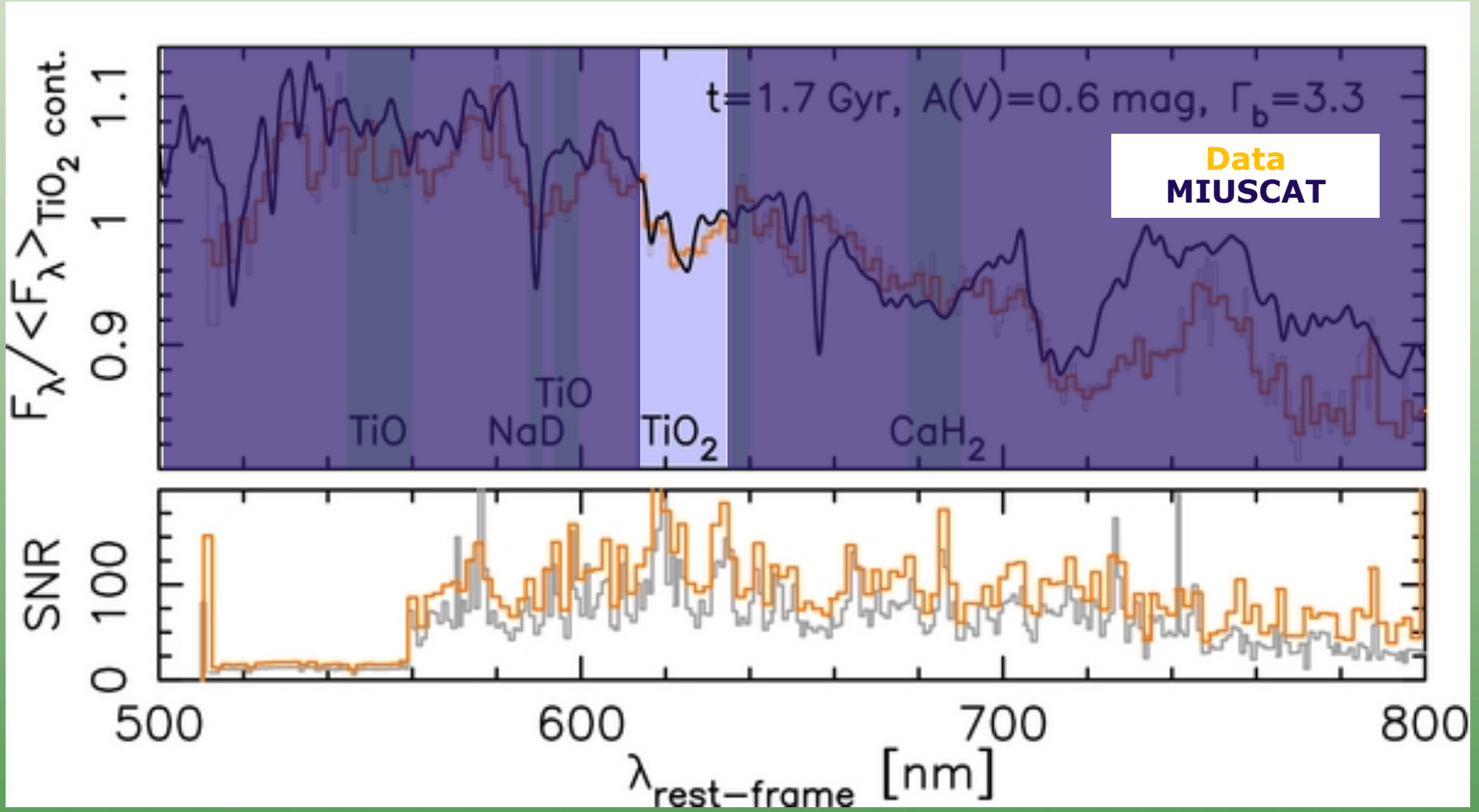
Domínguez-Sánchez, P-G+ (2015, in prep.)

Going beyond SFHs for z>1 massive dead galaxies



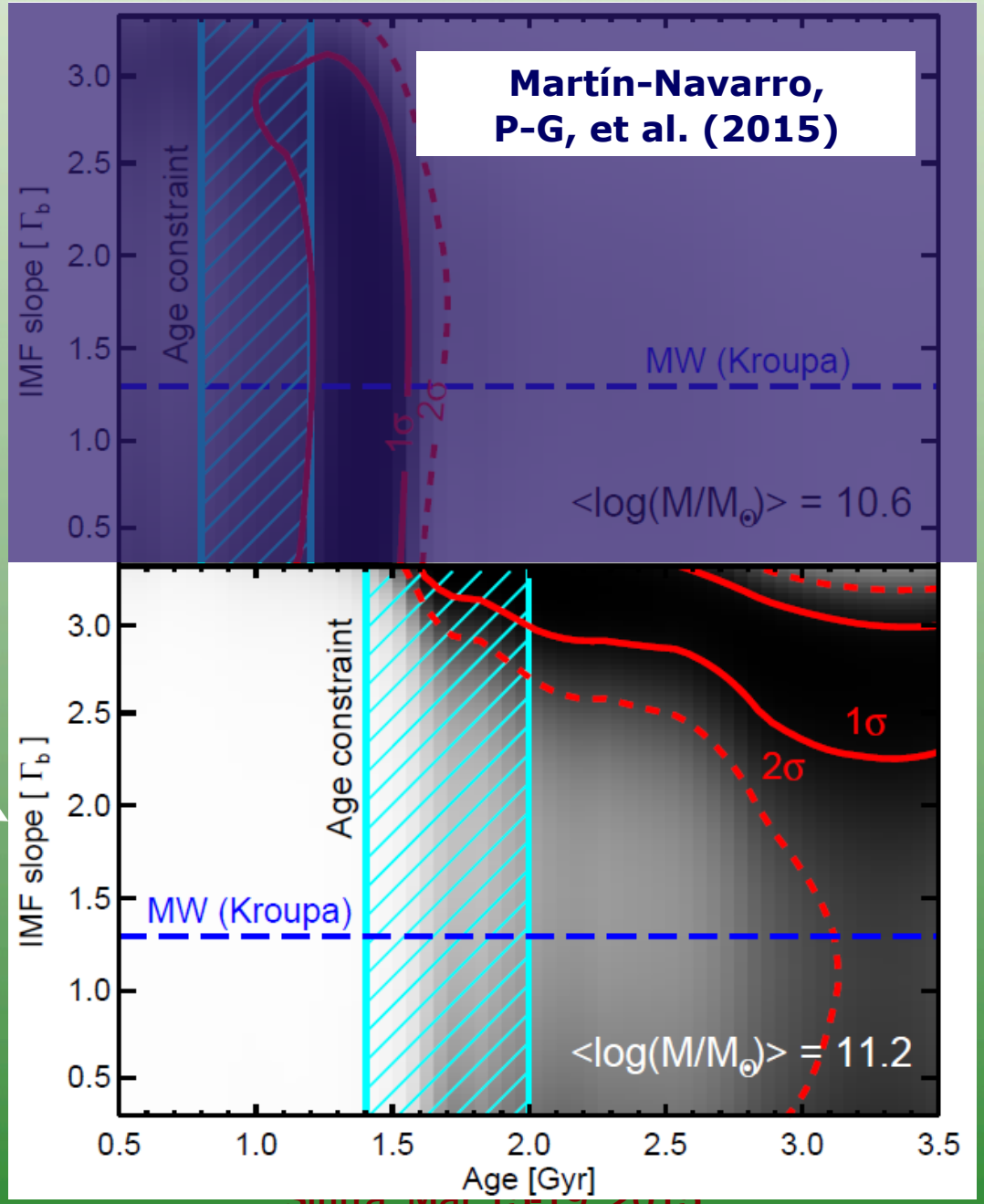


Going beyond SFHs for z>1 massive dead galaxies



Martín-Navarro, P-G, et al. (2015)

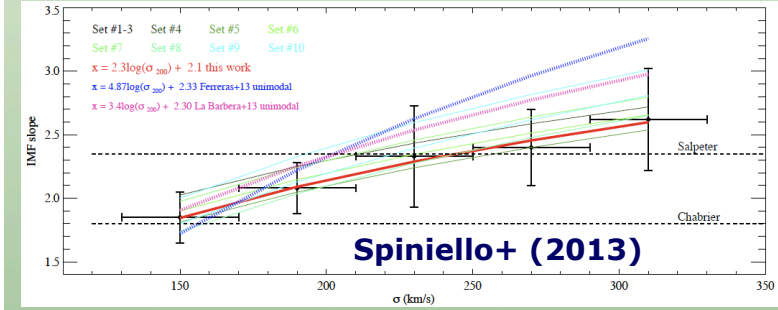
IMF sensitive features: TiO_2@z>1



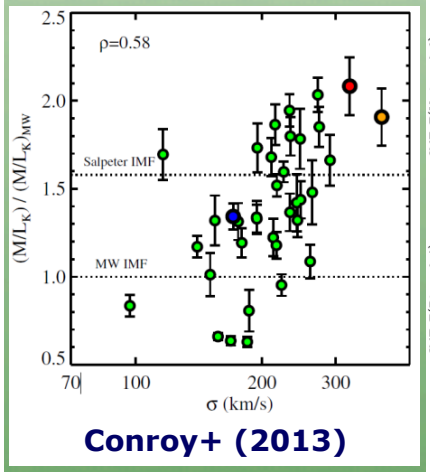
Bimodal (Kroupa-like) IMF slope (for high masses)

Evidence for bottom-heavy IMF at z>1

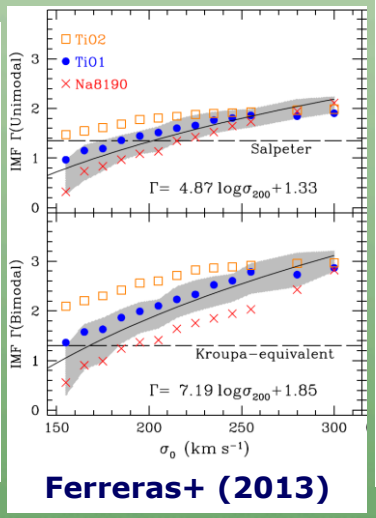
z~0



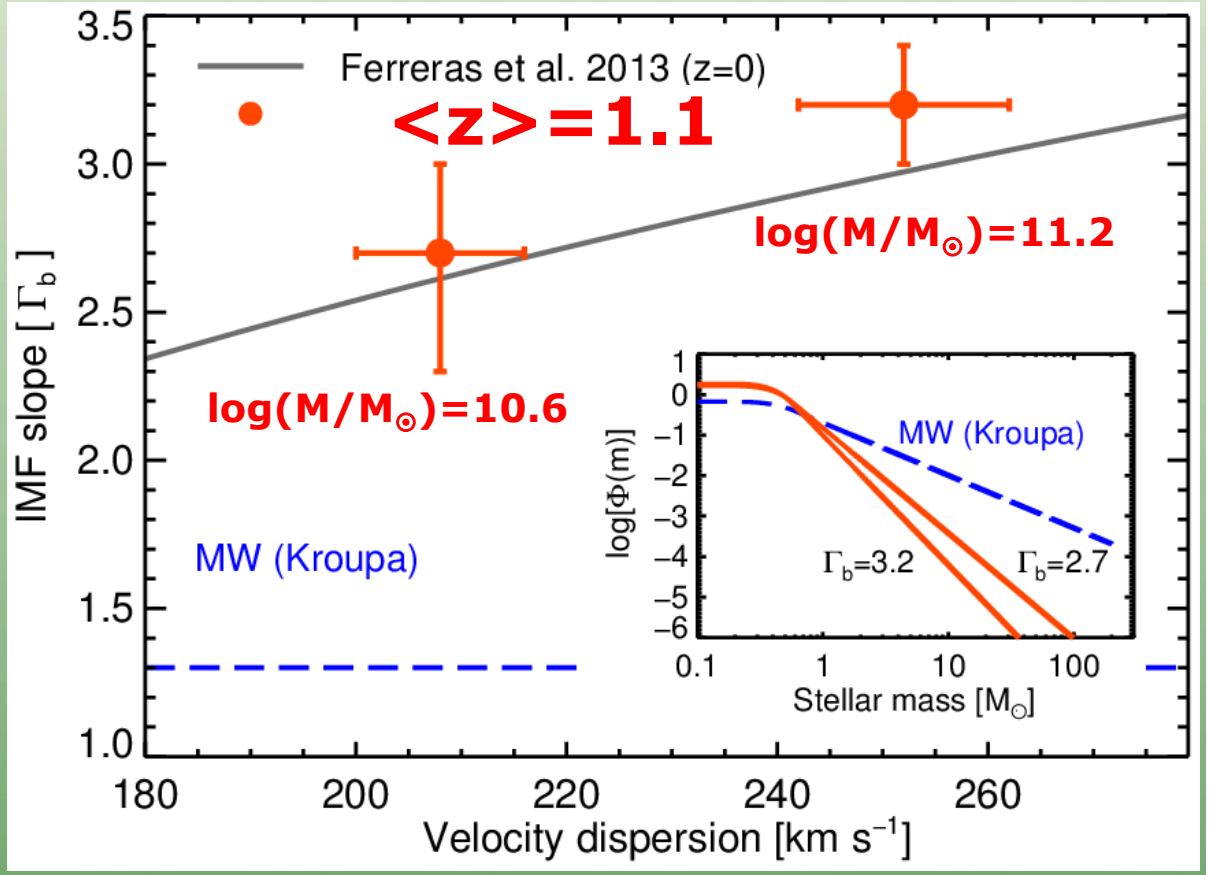
Spiniello+ (2013)



Conroy+ (2013)



Ferreras+ (2013)



Martín-Navarro, P-G, et al. (2015)

z~0: Cenarro+ (2003), Treu+ (2008), Thomas+ (2011), Cappellari+ (2012, 2013), Spiniello+ (2012, 2014), Conroy&van Dokkum (2012), Conroy+ (2013), Dutton+ (2013ab), Ferreras+ (2013), La Barbera+ (2013), Martín-Navarro+ (2014a), Shetty+ (2014),...
and also
Borch+ (2006), P-G+ (2008), Davé+ (2008), Wilkins+ (2008), van Dokkum+ (2008),...

Details about the SFHs of massive dead galaxies at z>1

- **Using R~50 data (SHARDS+WFC3 grisms) we can break stellar population synthesis degeneracies and get reliable SFHs. And the IMF!**

- **Properties of massive (>10^{10} $M_\odot$) dead galaxies @ 1.0<z<2.0:**
  - **Some massive dead galaxies at 1.0<z<1.5 are quite old (>2 Gyr; dead by z~2); most are "new arrivals" (<2 Gyr).**
  - **No correlation between mass and SF timescale, but older galaxies present more extended SFHs (unlike in Thomas+ 2005). Dual quenching mode? Excursions in&out of the red sequence? Early mergers?**
  - **TiO_2 index from WFC3/G141 data and ages from SHARDS points out to a bottom-heavy IMF (i.e., not universal) for the most massive dead galaxies at z>1.**