

MAGINASTE: Science case for z~1 massive galaxies

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EMIR-RIA

Cádiz, 23-24/11/2017

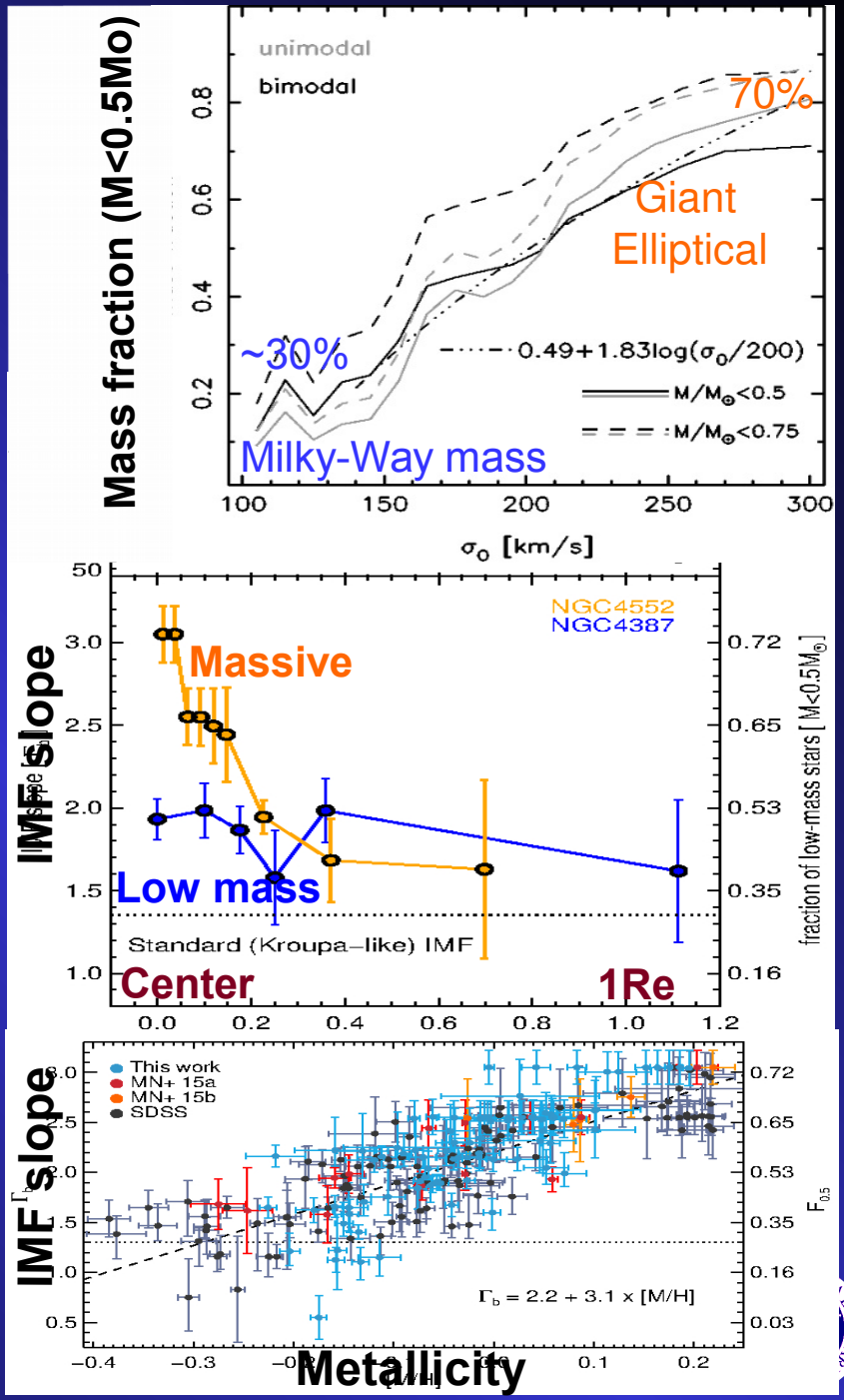
The IMF in ETGs

Recent detailed spectroscopic stellar population studies in nearby massive ETGs increasingly support a non universal IMF:

<u>Varies with galaxy mass</u>: massive ETGs are enhanced in low-mass (<0.5Mo) dwarfs: IMF - σ relation (Cenarro+03; van Dokkum & Conroy 10; Ferreras+13; LaBarbera+13)

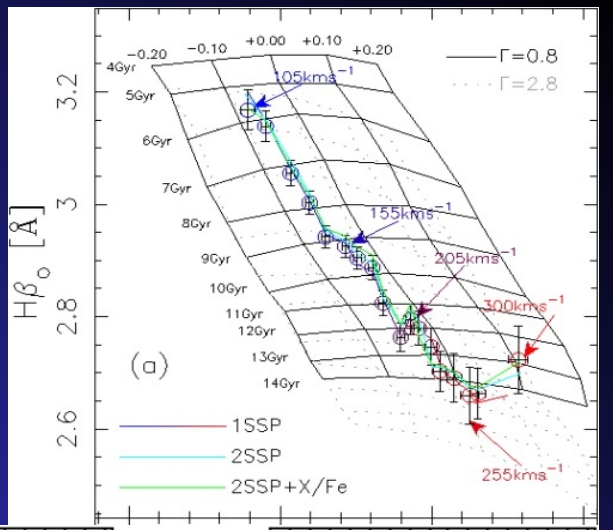
<u>Varies localy within massive galaxies</u>: bottom-heavy in the center & MW-like at >0.5Re (Martín-Navarro+15a; LaBarbera+16;van Dokkum+17)

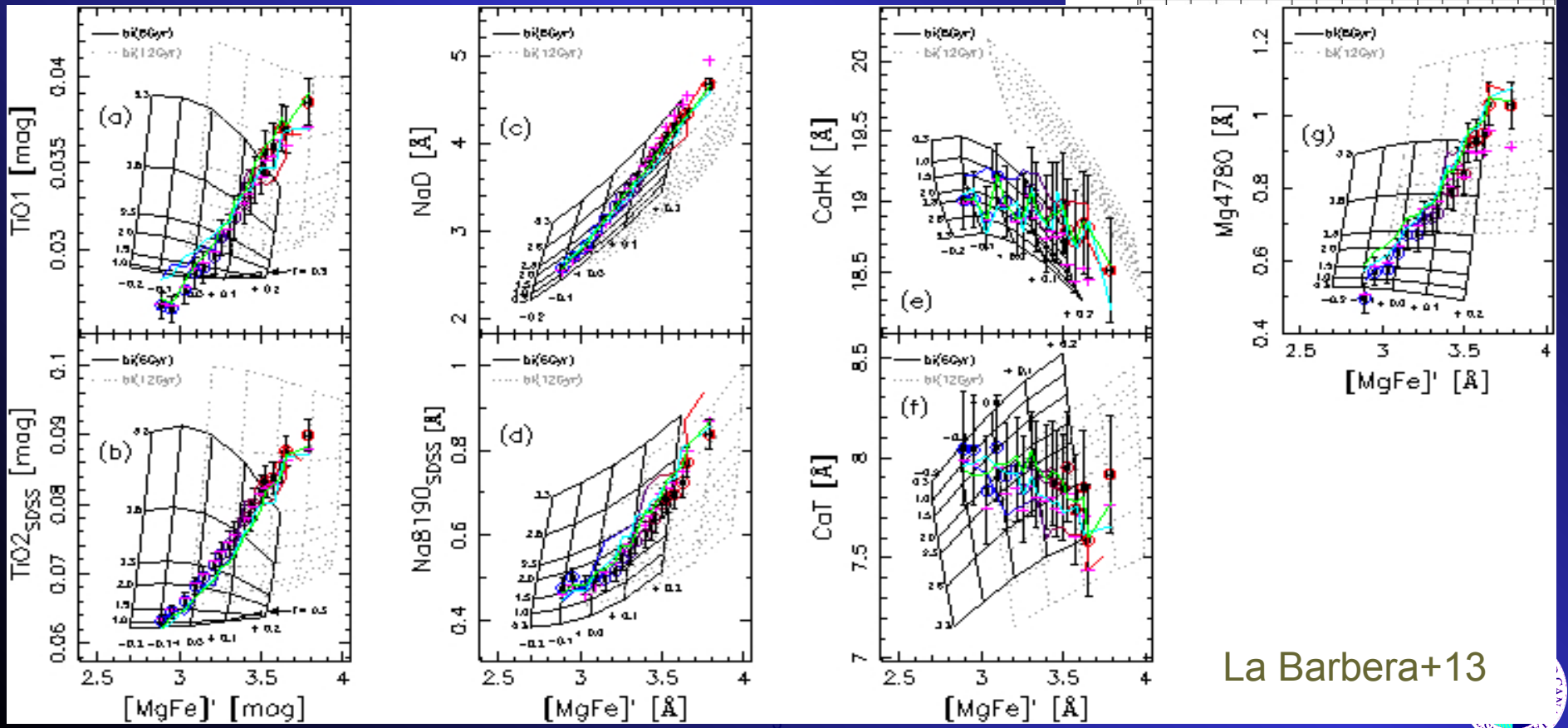
<u>Correlates with metallicity</u>: both global and localy (Martín-Navarro+15b)



IMF in ETGs

- 40000 ETGs from the SDSS. Stacked galaxy spectra according to velocity dispersion (σ)
- More massive galaxies, with larger σ, are older and more metal-rich.
- Use of IMF-sensitive indices:



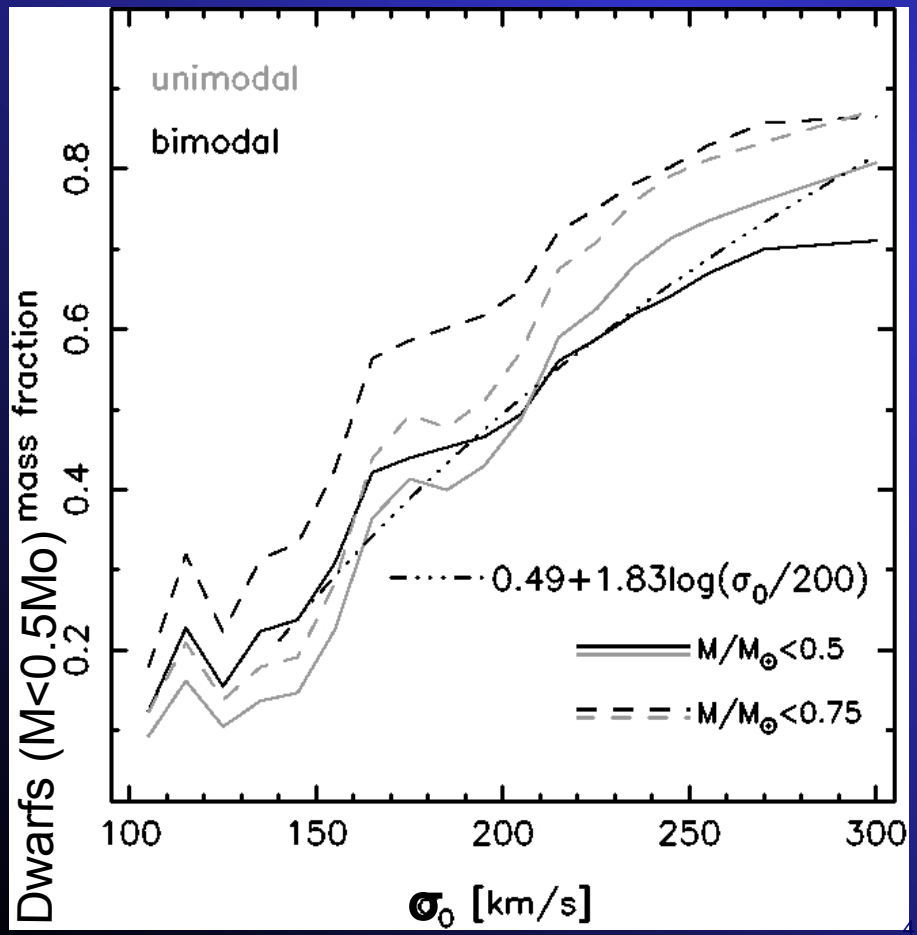


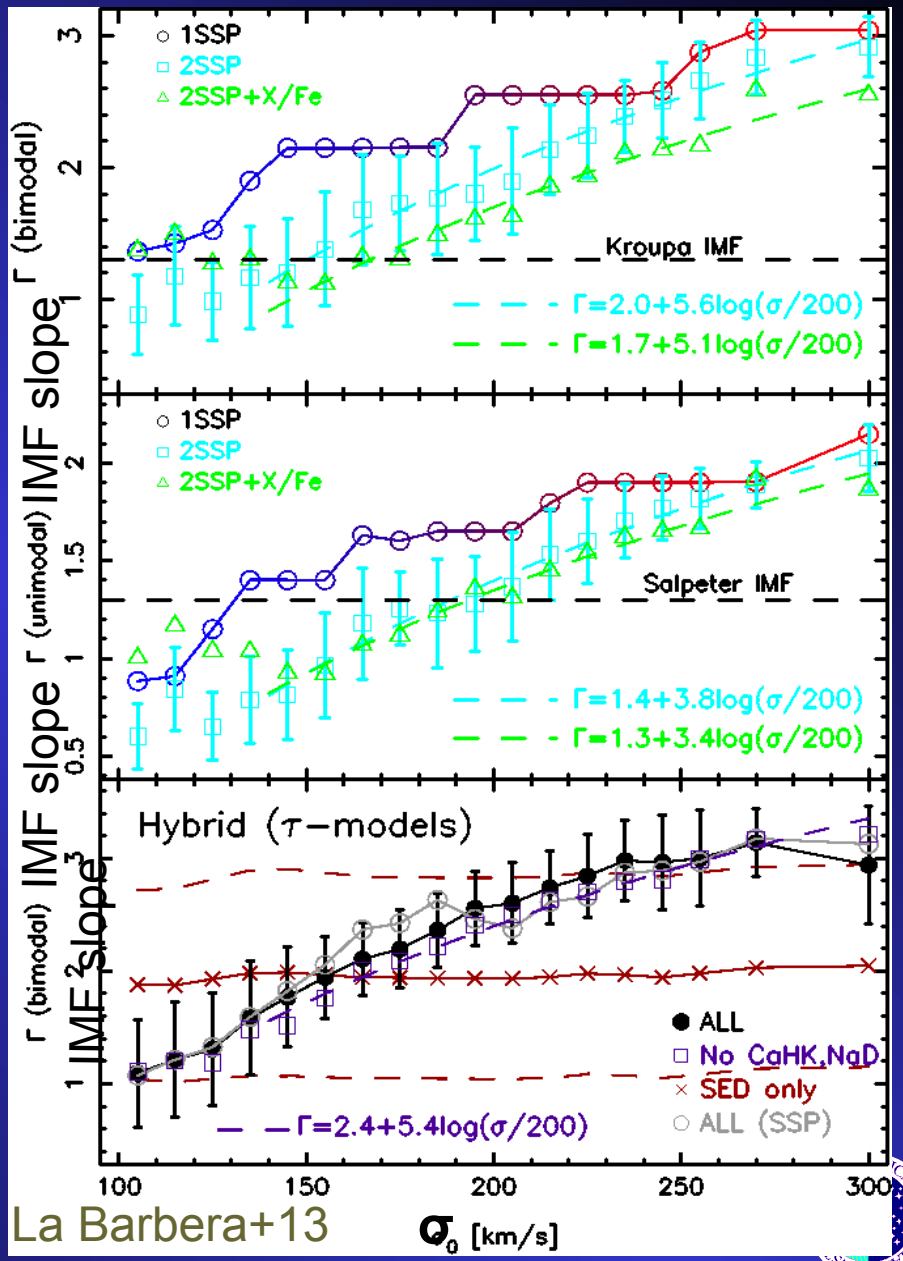
La Barbera+13

IMF in ETGs: IMF-σ relation

IMF slope steepens with increasing σ .

Massive ETGs show a larger mass-fraction of stars with M<0.5Mo (~70%) than is found in the Milky Way (~30%).

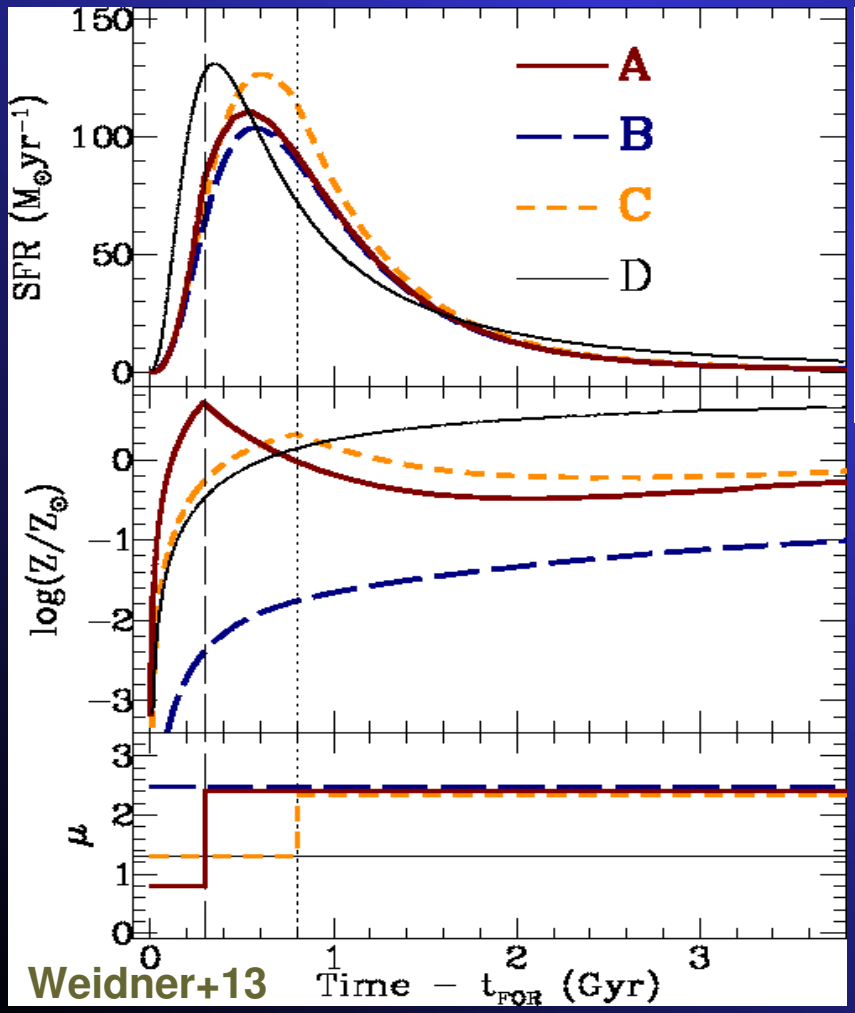




La Barbera+13

Did the IMF vary over cosmic time?

An invariant bottom-heavy IMF prevents reaching solar metallicity (or higher): it should have evolved over time from top- to bottom-heavy (V+96,97;Weidner+13;Ferreras+15).

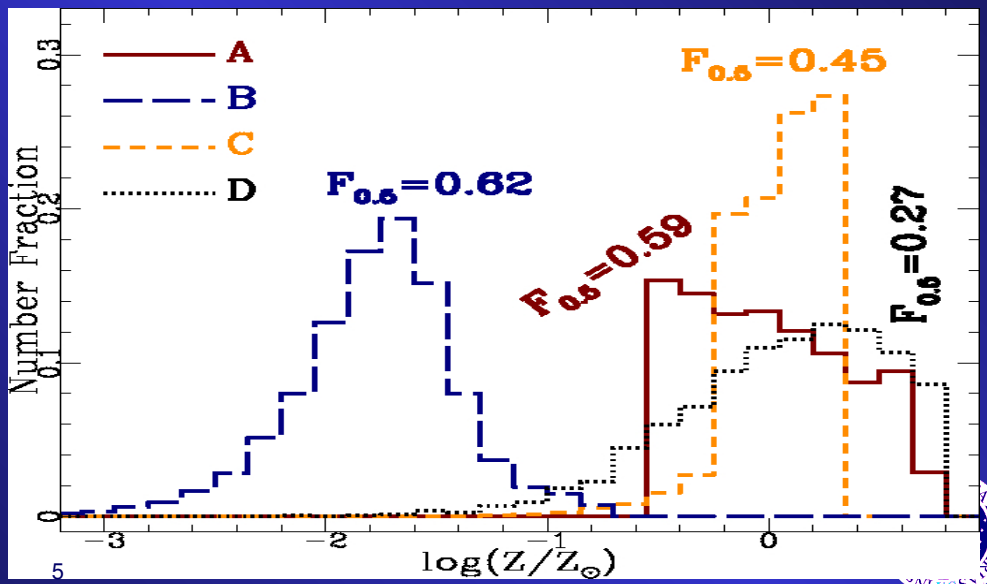


From Γ=0.8 to 2.4, short transition phase

Invariant bottom-heavy Γ=2.4

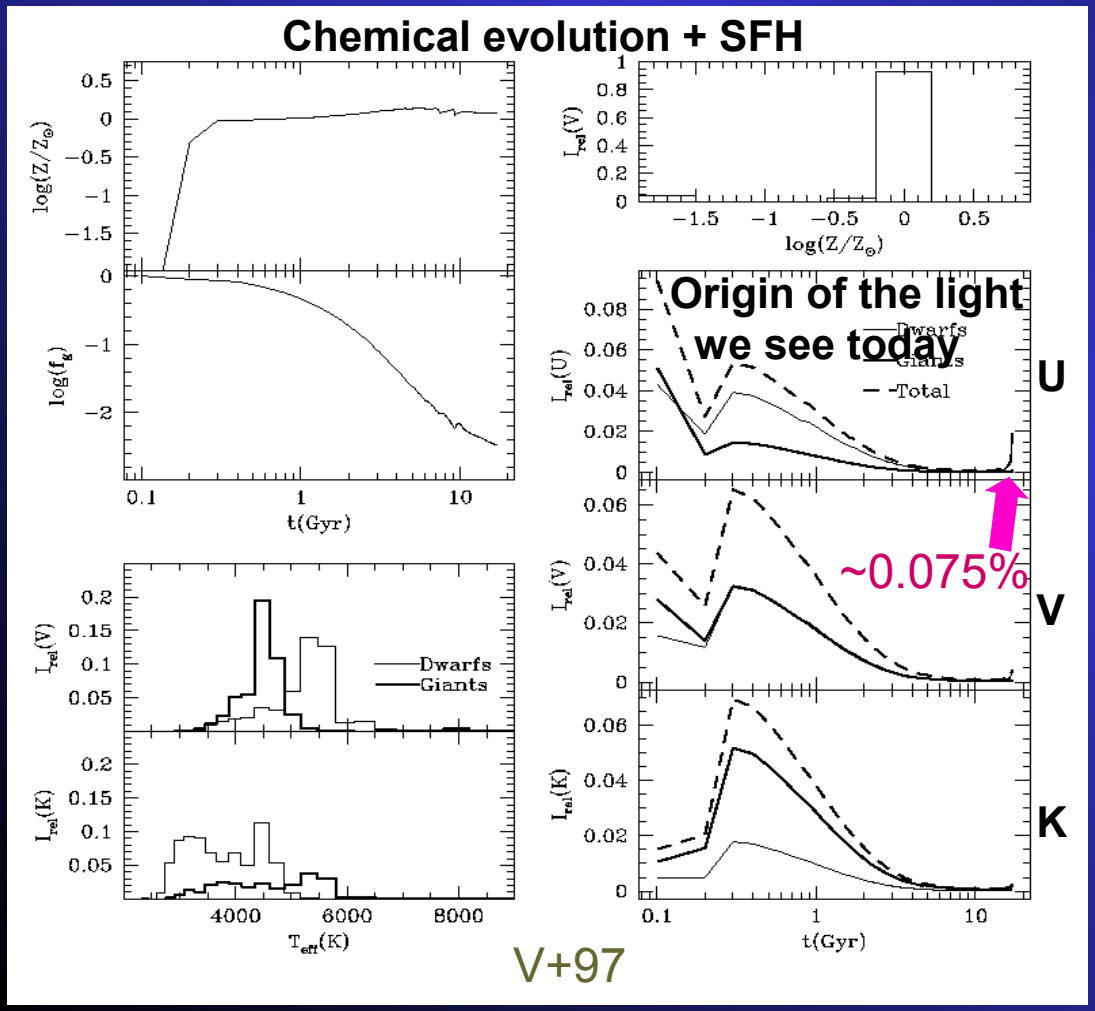
From Γ=1.3 to 2.4, longer transition

Invariant Kroupa

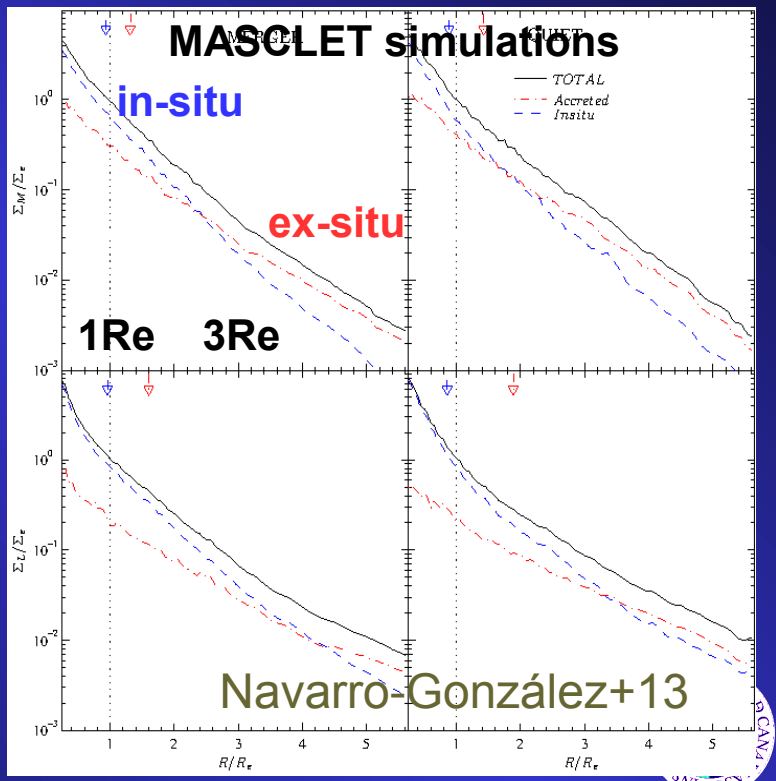


A two phase time-varying formation scenario for ETGs

1) A monolithic-like in-situ phase with a fast (< 0.5Gyr) IMF transition from top to bottom-heavy. The more massive the more dramatic and faster the transition!
2) Later accretion (with standard IMF) that settle in galaxy perifery. It leads to passive evolution with residual SF and "no ex-situ" contributions within ~1Re.

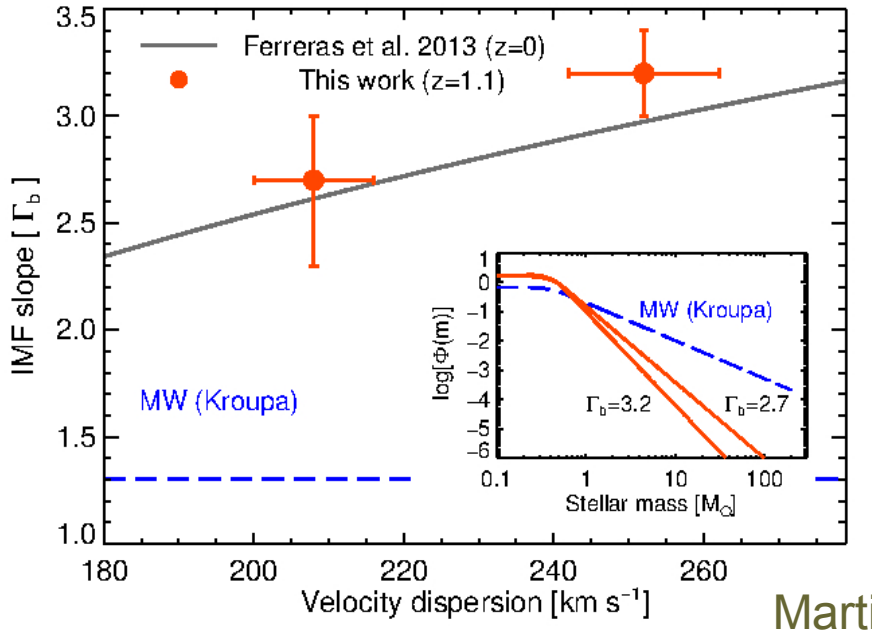


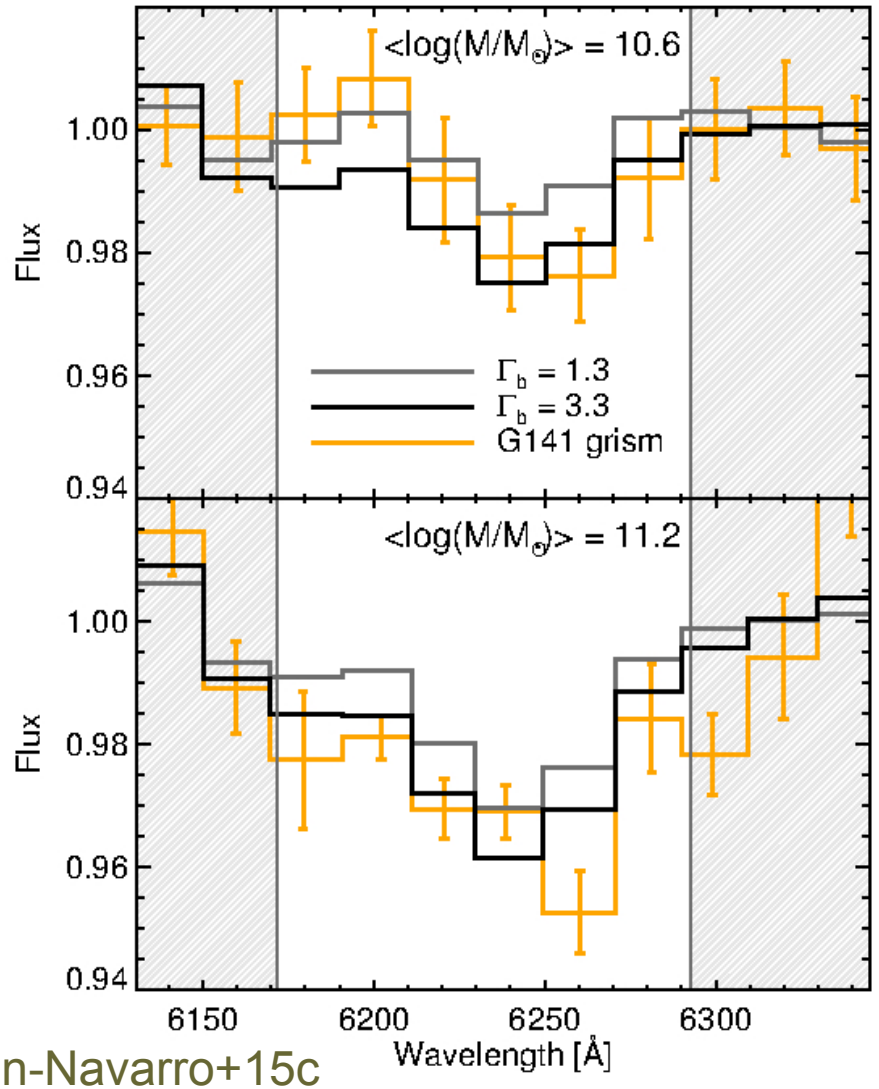
Cosmological numerical simulations: major "in-situ" contribution within < 1-3 Re



IMF in ETGs: IMF at z~1.2 (~ 1/3 the age of Universe)

Massive and intermediate-mass galaxy stacks at z~1.2 with SHARDS@GTC show similar IMF trends as found in nearby galaxies



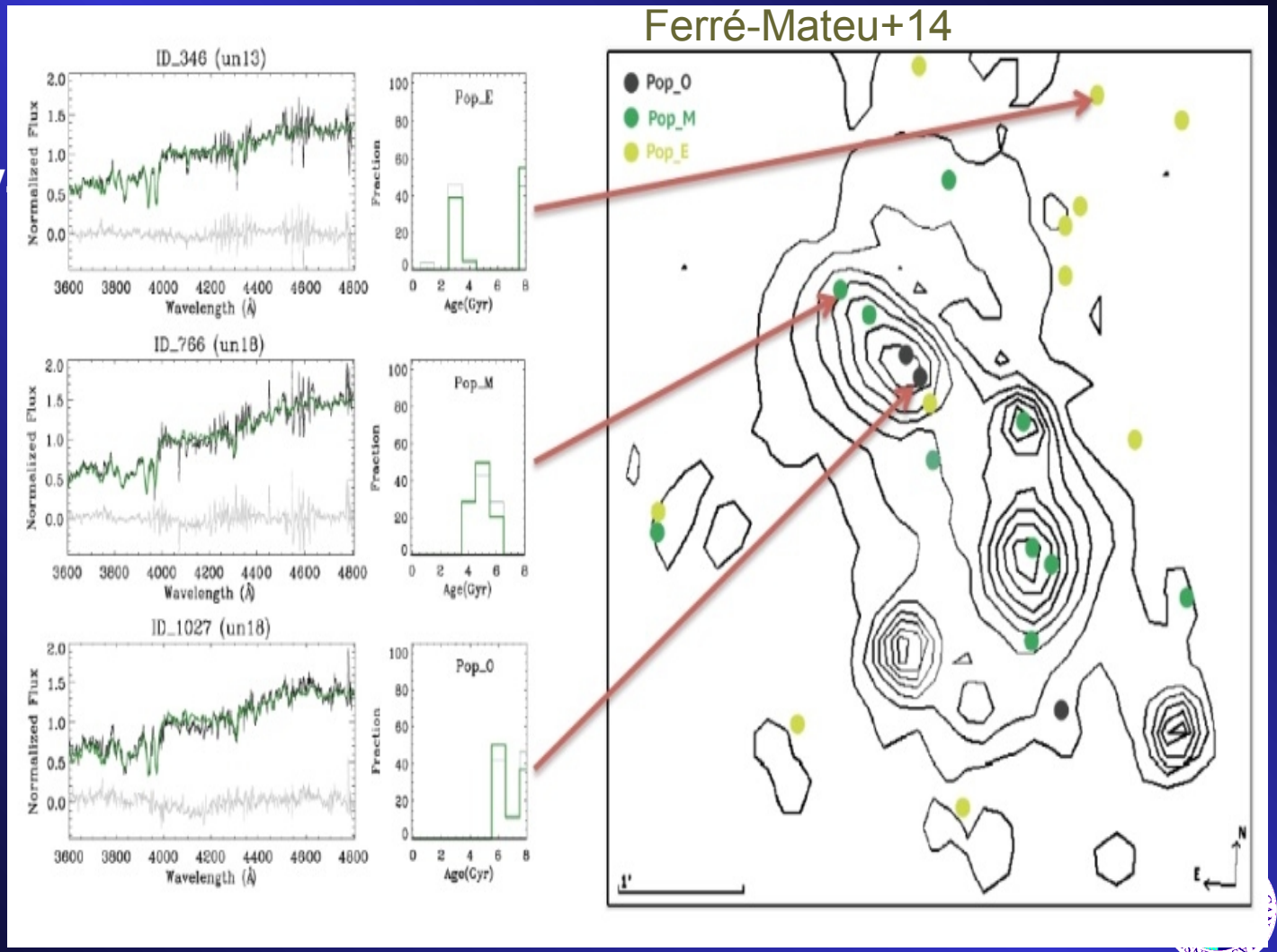


Martin-Navarro+15c

Evolution with redshift

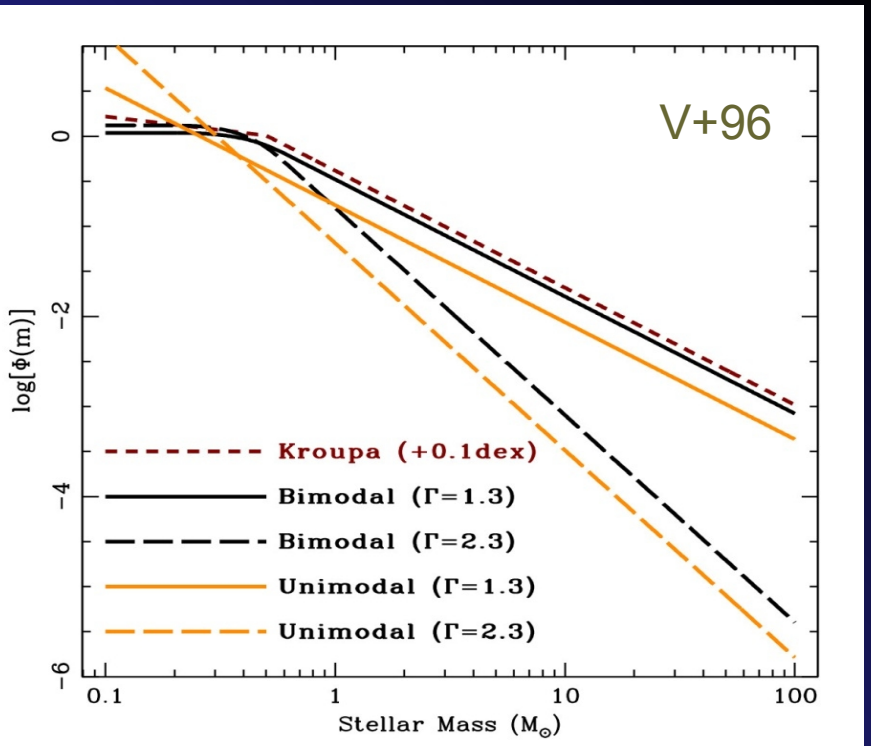
Detailed spectroscopic analysis of individual galaxies in a massive cluster at z~0.8 (similar to Coma):

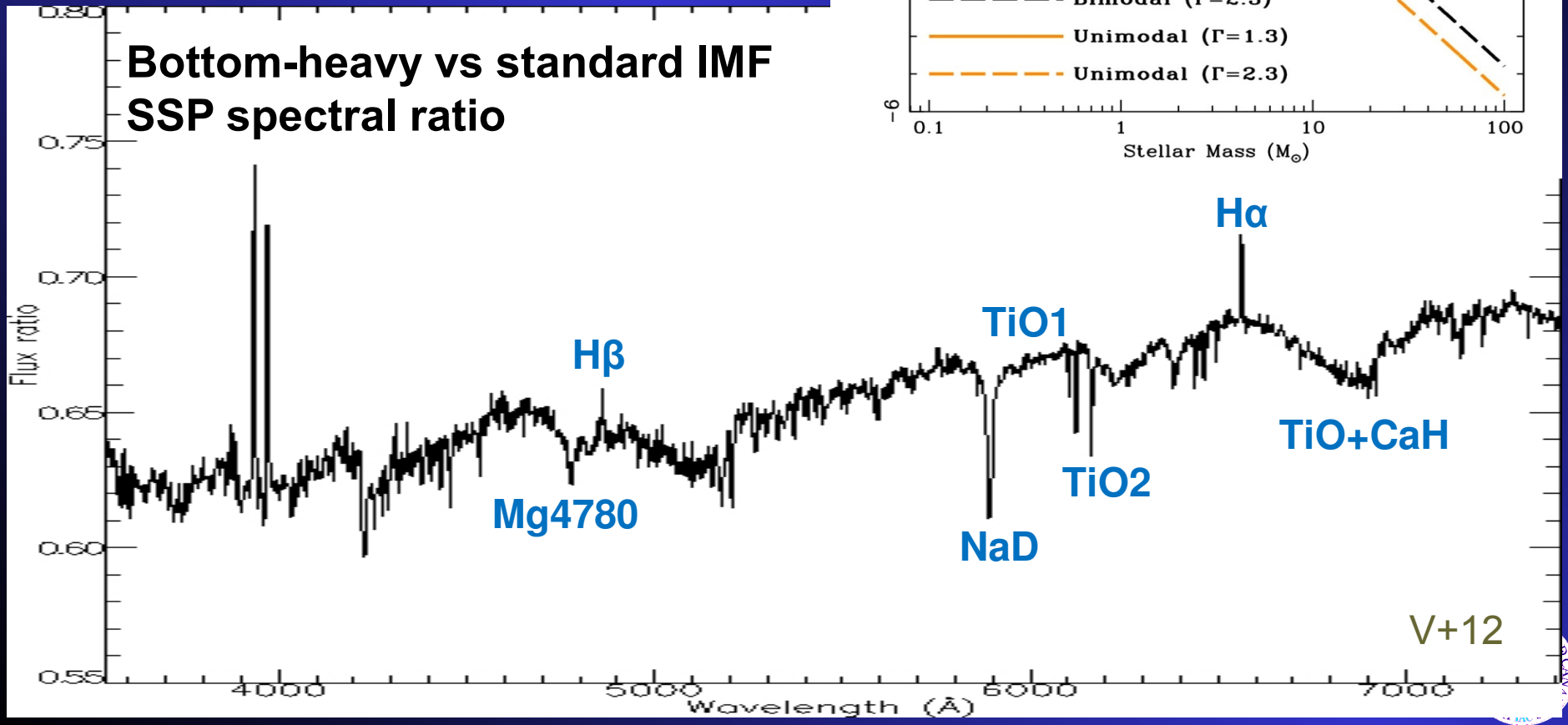
- **Massive galaxies are found in the denser regions evolving passively. Their lower mass counterparts are located on the cluster perifery and their full spectrum-fitting show more extended SFHs.**
- **Their line-strengths show abundance patterns already similar to Coma**



IMF sensitive features

IMF-sensitive atomic & molecular bands can be used to constrain the IMF of ETGs





Can we measure the IMF sensitive features at z~1?

