Outside-in star formation in the outer disc of the LMC

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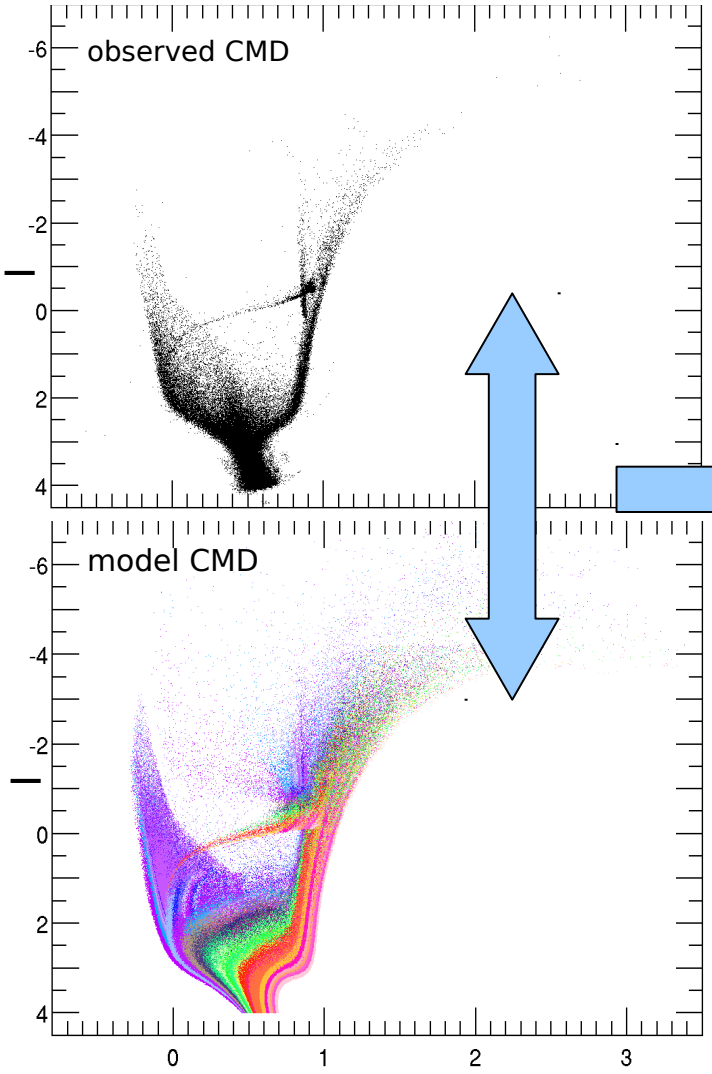
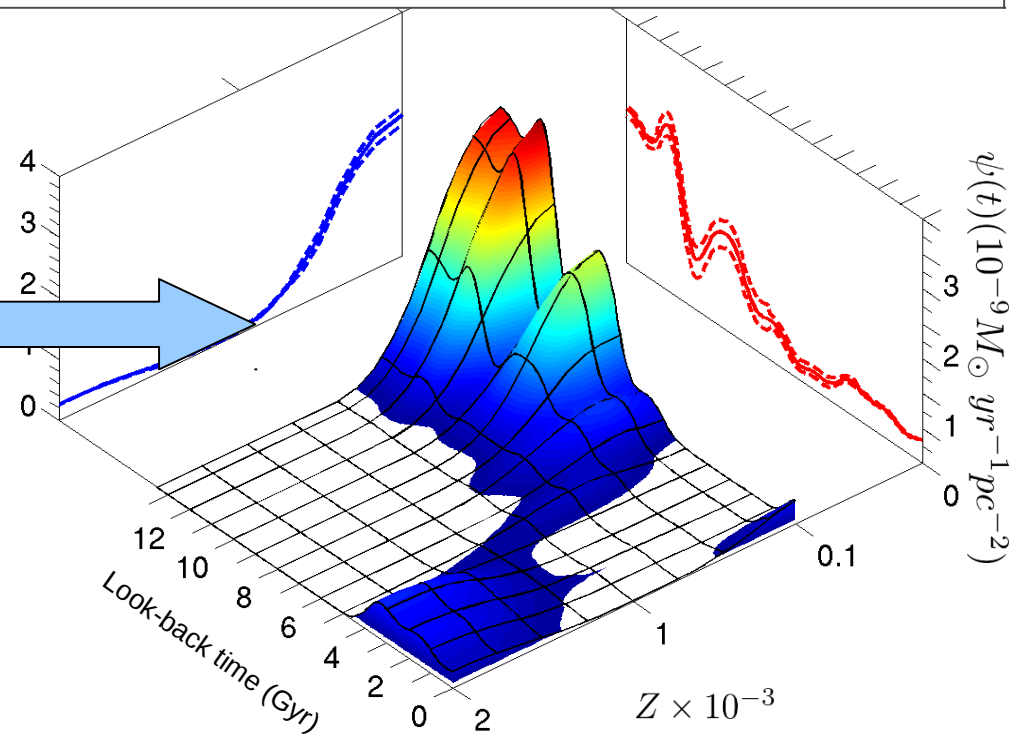
etrieving Star Formation History of Resolved Systems



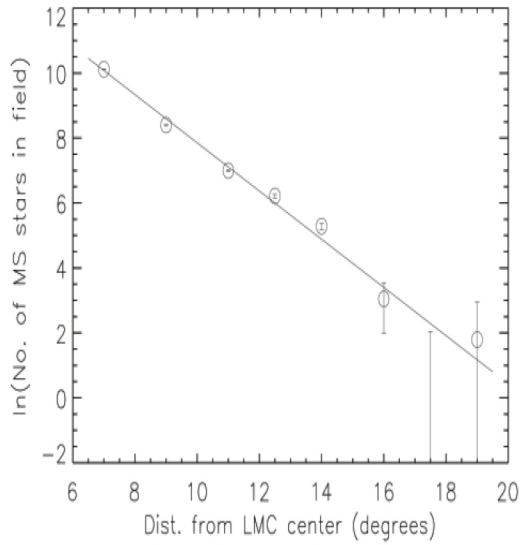
The distribution of stars in the observed CMD is compared with that of a number of *simple populations* in a model CMD.



Aparicio & Gallart (2004)
Aparicio & Hidalgo (2009)

By using a merit function, we obtain the combination of simple stellar populations that best reproduces the observed CMD, i.e., the star formation rate and the chemical evolution law, as a function of time.

The outer regions of the LMC: extended disk or halo

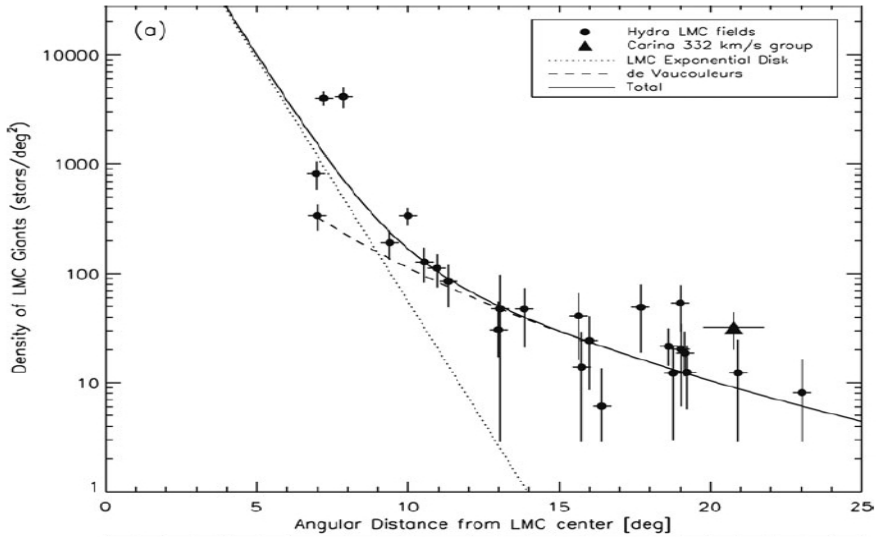


Saha et al (2010), NOAO newsletter

Magellanic Clouds: nearby, interacting systems
→ HUGE sky area coverage

There is evidence of LMC star at large distance from the centre (out to 16 degrees at least)

Are we seeing an extended disk?



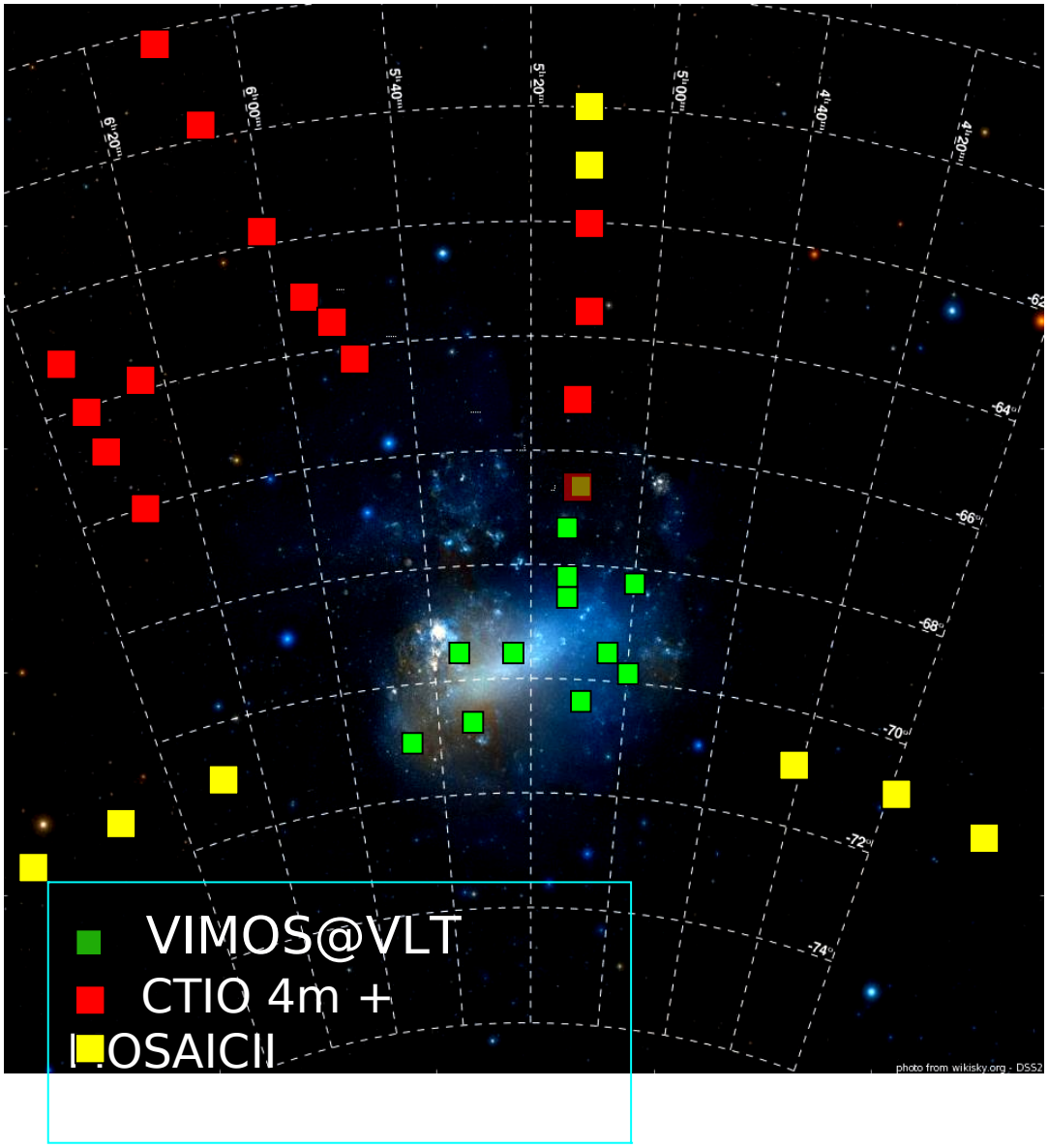
Majewski et al (2008), IAUS 256 Proc.

Is there a transition to an “halo”?

SFH of the LMC: gradients in the disk

CMDs reaching the oldest main sequence turnoffs in
15 fields CTIO+MOSA (35'x35')
8 fields 2.2 ESO+WFI (35'x35')
12 fields VLT+VIMOS
9 WFPC2 fields
+
Spectra
- medium resolution CaT for ≈900 member stars in 4 fields
- FLAMES high resolution spectra for ≈300 stars

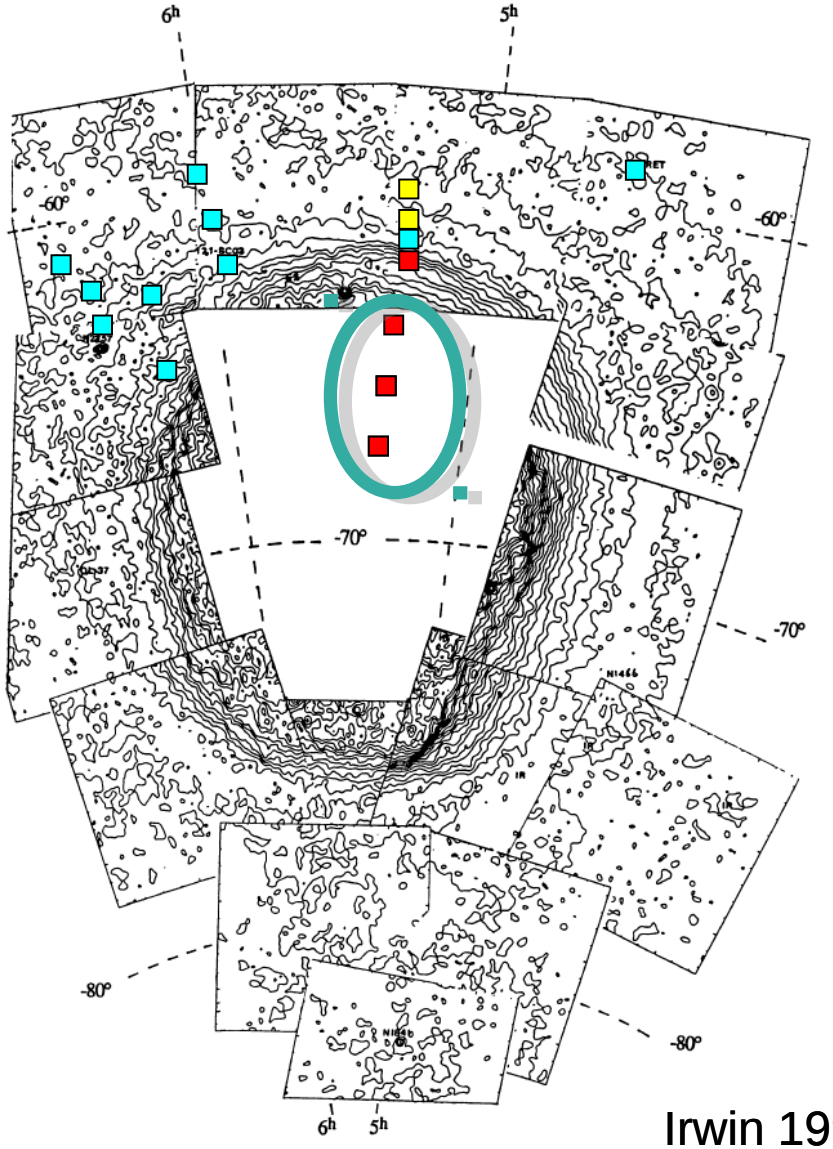
Team
Gallart, Monelli, Monteagudo, Stetson, Carrera (Noel, Meschin)



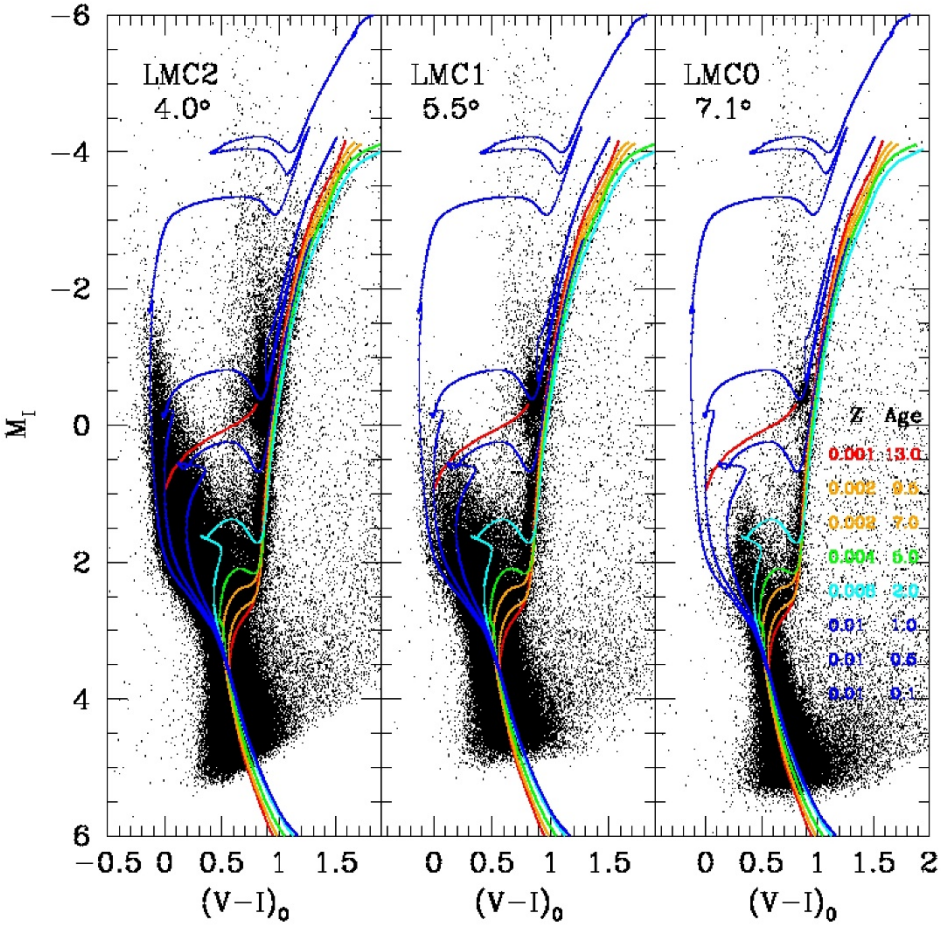
Gallart et al. 2004, 2008, AJ
Carrera, et al. 2008a ,b, 2011
Meschin,et al. 2014, MNRAS
Monelli, et al. 2015 a,b in prep

SFH of the LMC: gradients in the disk

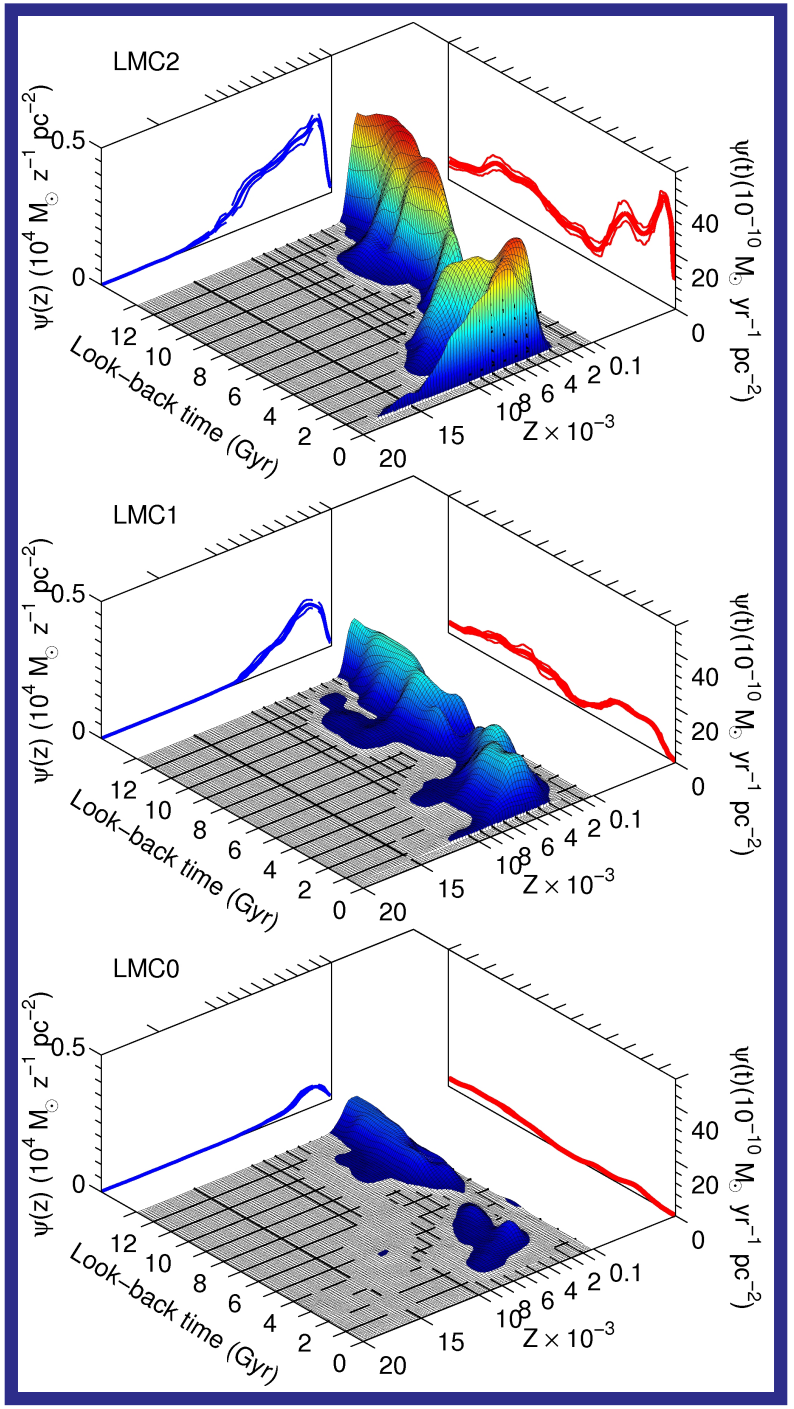
- New data to map the same discontinuity in various directions



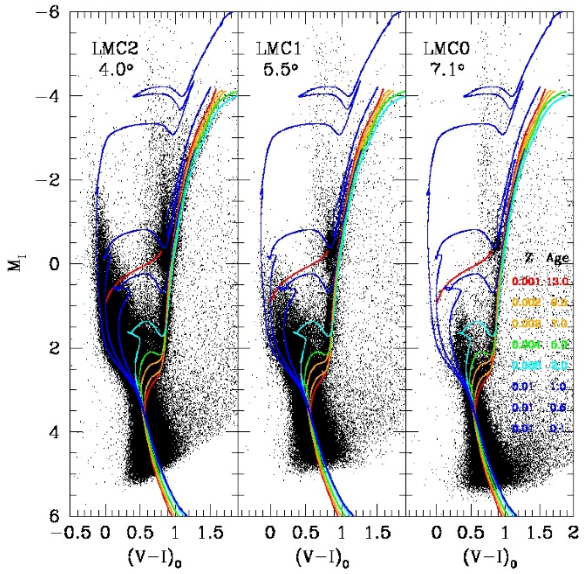
Irwin 1991

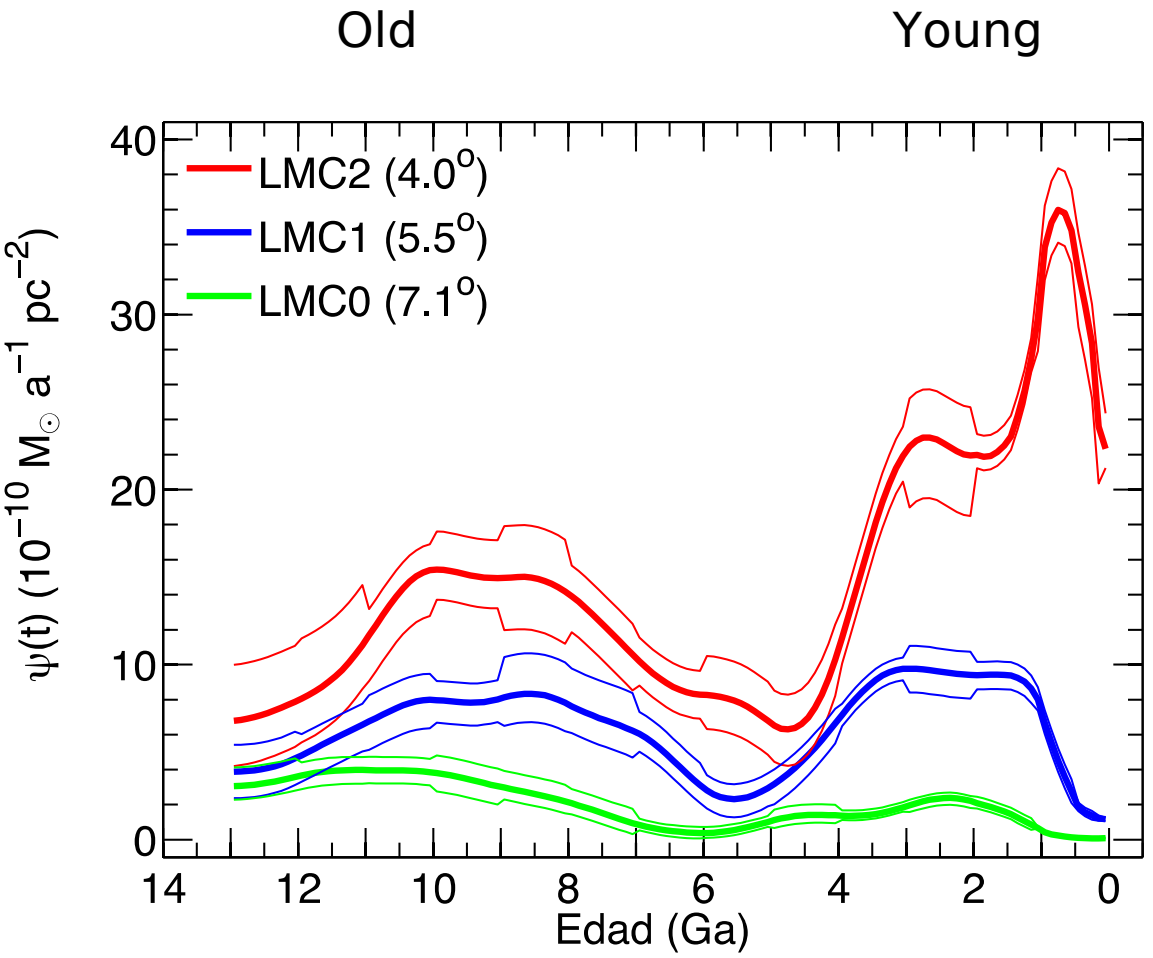


Meschin et al. 2014



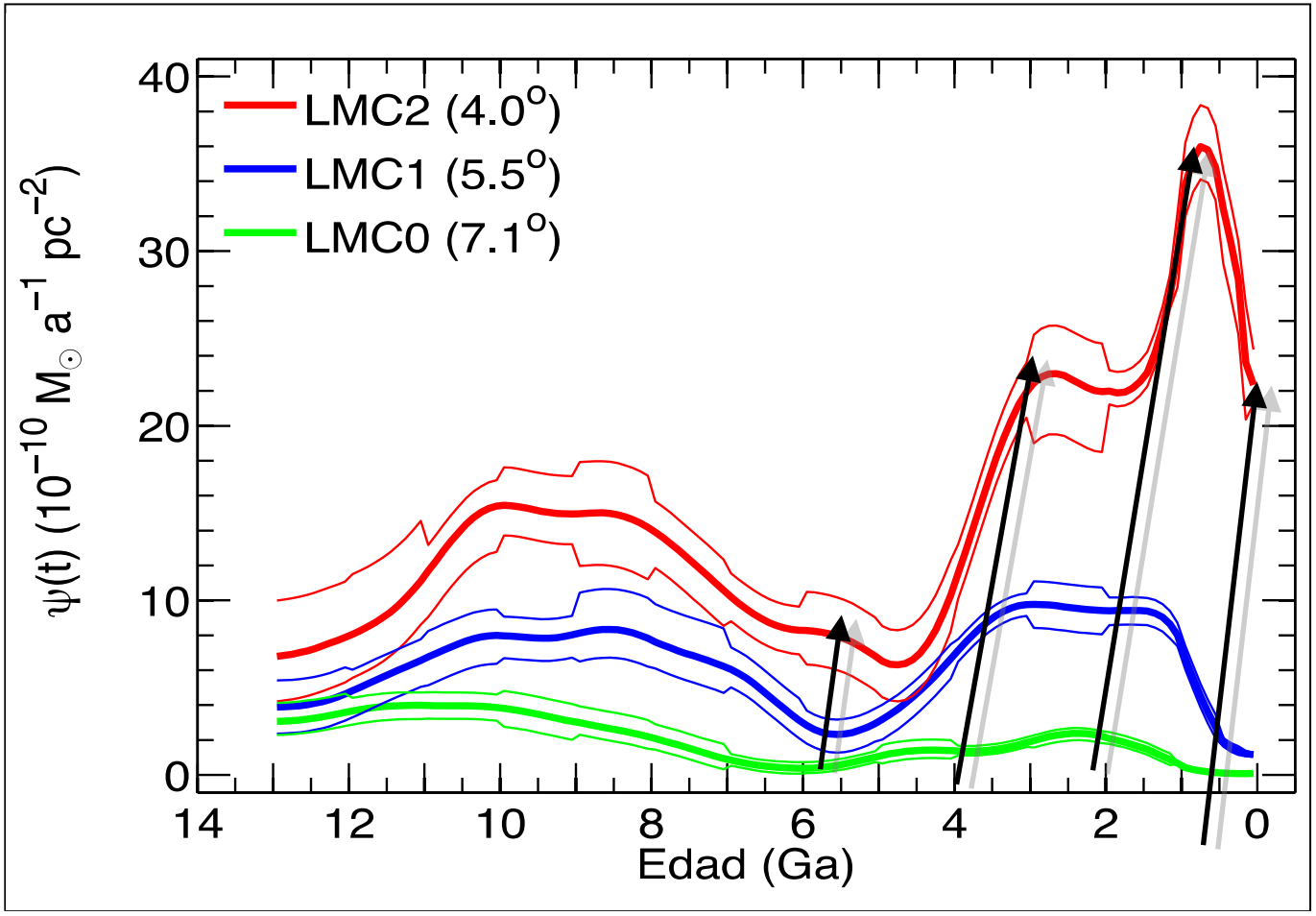
SFH of the LMC: gradients in the disk





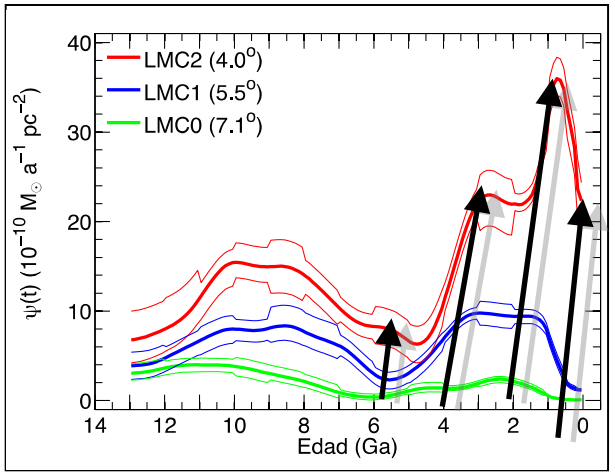
Y_{SFE}/O_{SFE}=(1.1 : 0.8 : 0.4) for (LMC2 : LMC1 : LMC0)

SFH of the LMC: gradients in the disk

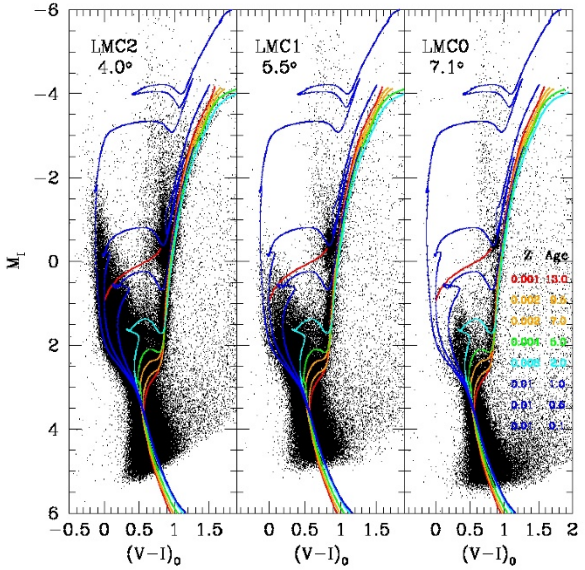


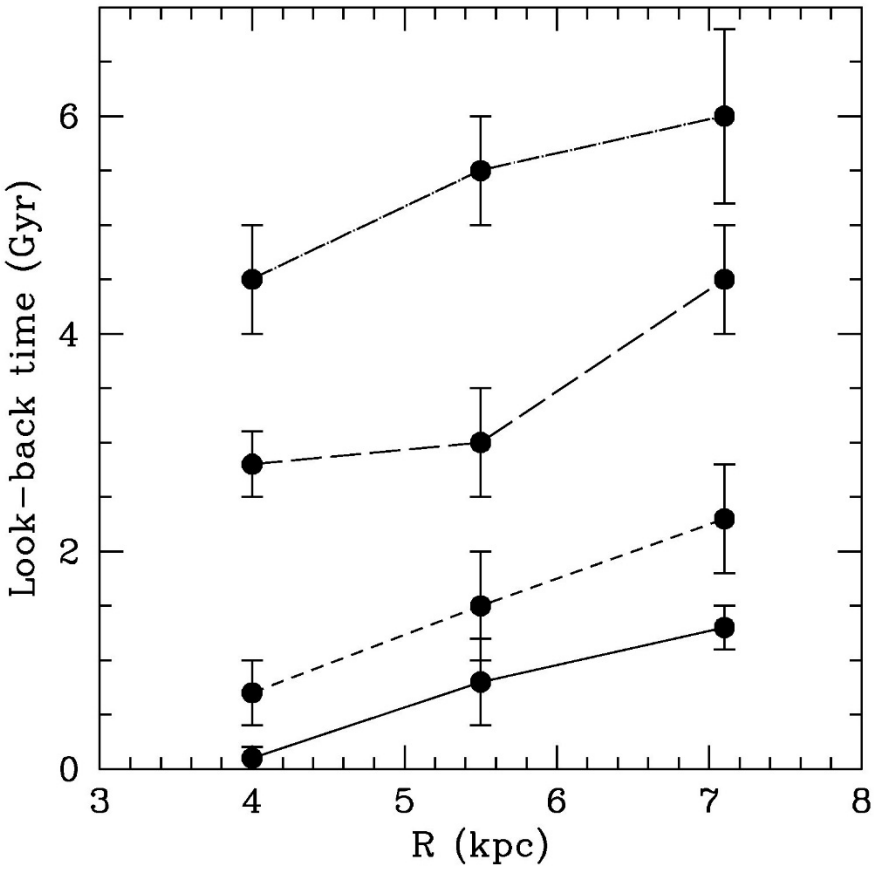
Feature migration with radius?

SFH of the LMC: gradients in the disk



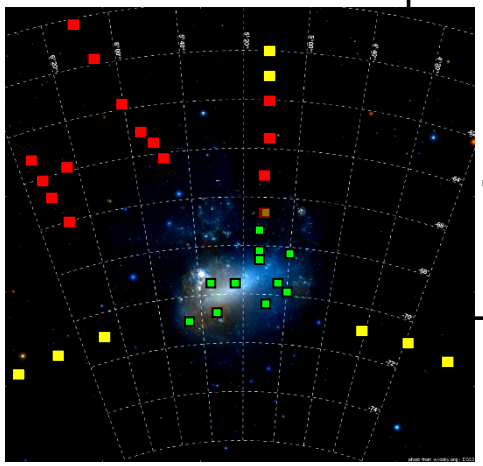
Meschin et al. 2013





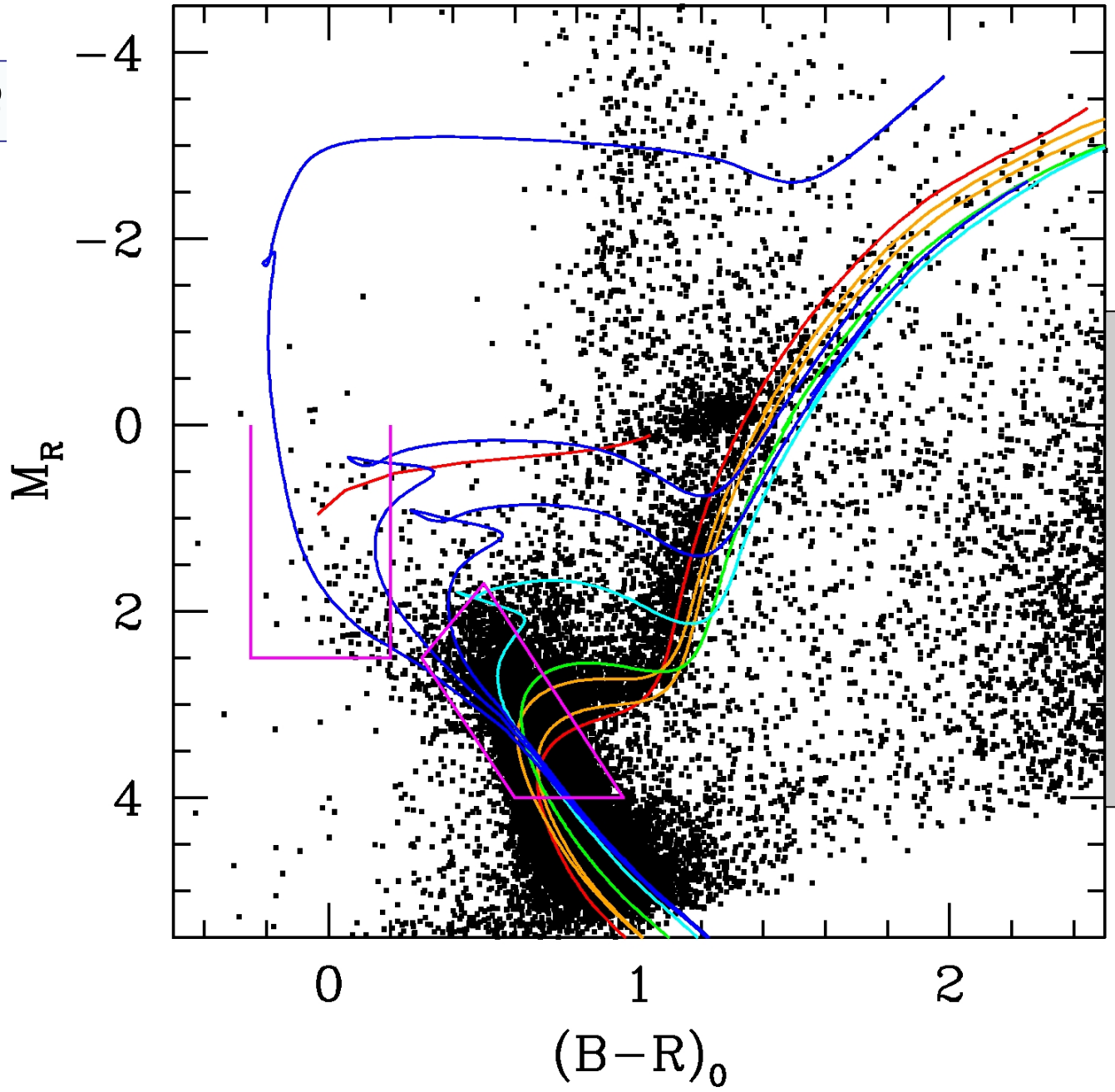
Various features in the SFR(t) ‘migrate’ as a function of radius at a rate of ≈ 0.4 Gyr/Kpc

R=7.6º



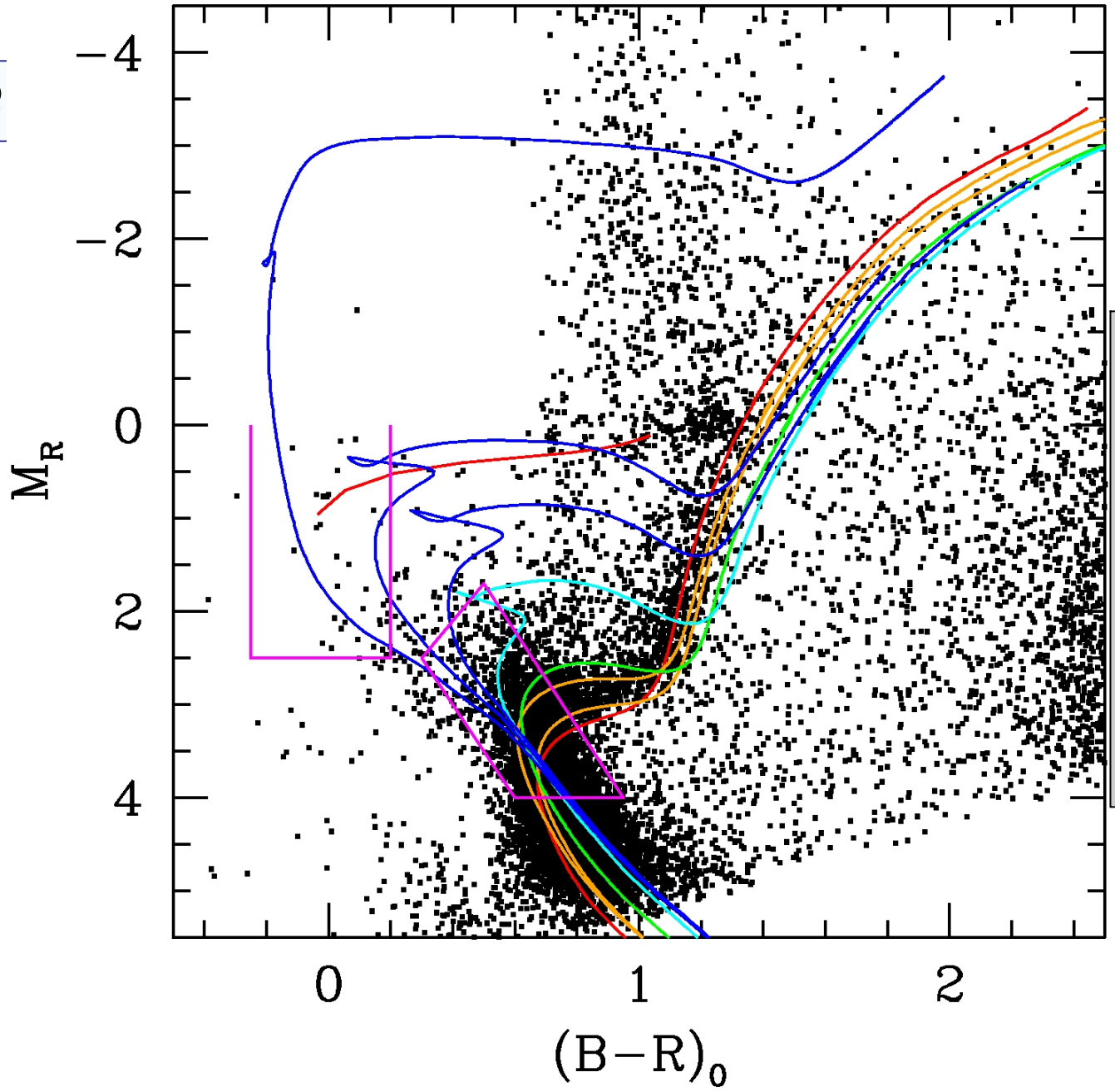
Z	Gyr
0.001	13.0
0.002	9.5
0.002	7.0
0.004	5.0
0.008	2.0
0.010	1.3
0.010	0.8
0.010	0.1

R=8.3º



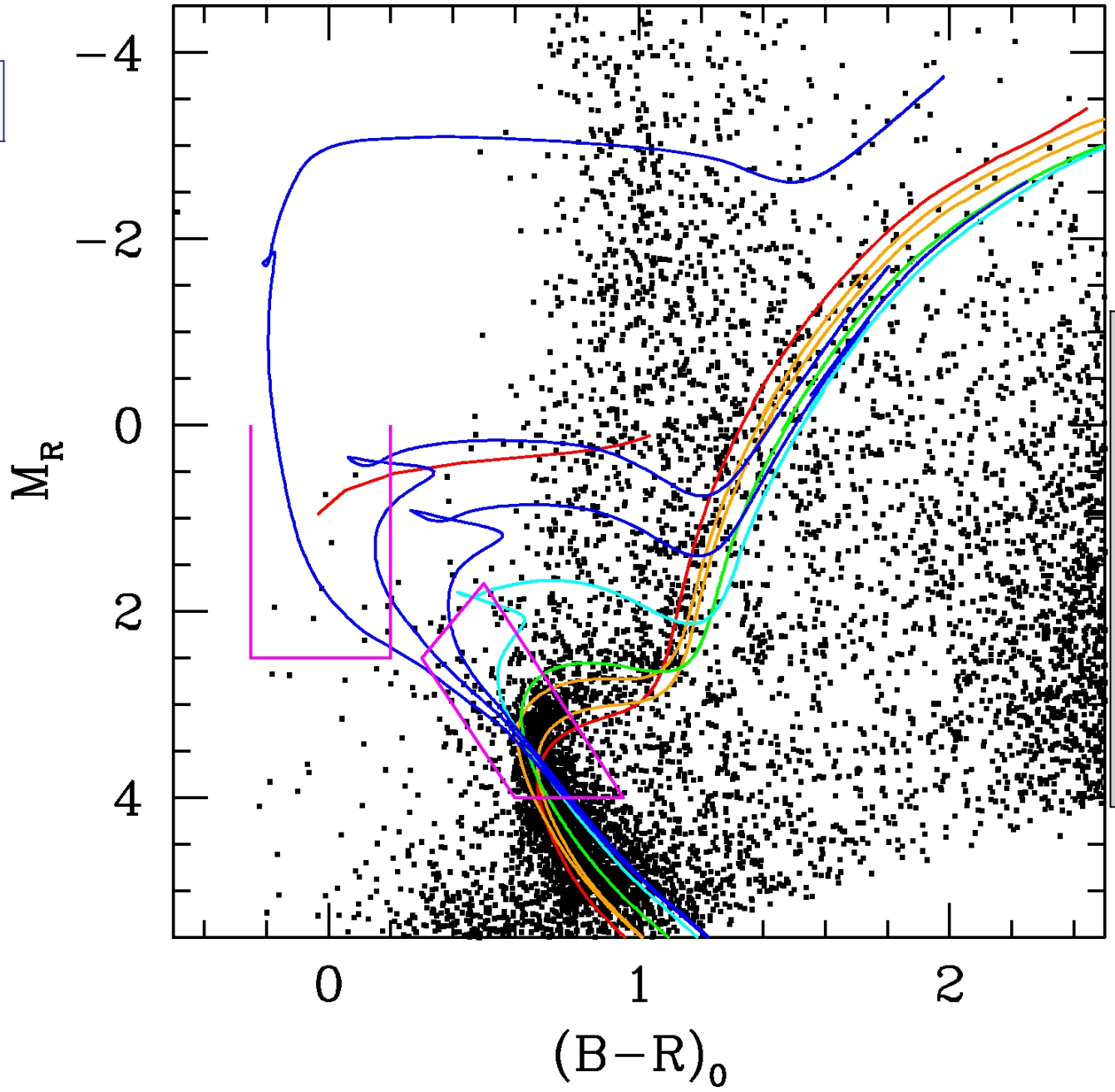
Z	Gyr
0.001	13.0
0.002	9.5
0.002	7.0
0.004	5.0
0.008	2.0
0.010	1.3
0.010	0.8
0.010	0.1

R=8.8º



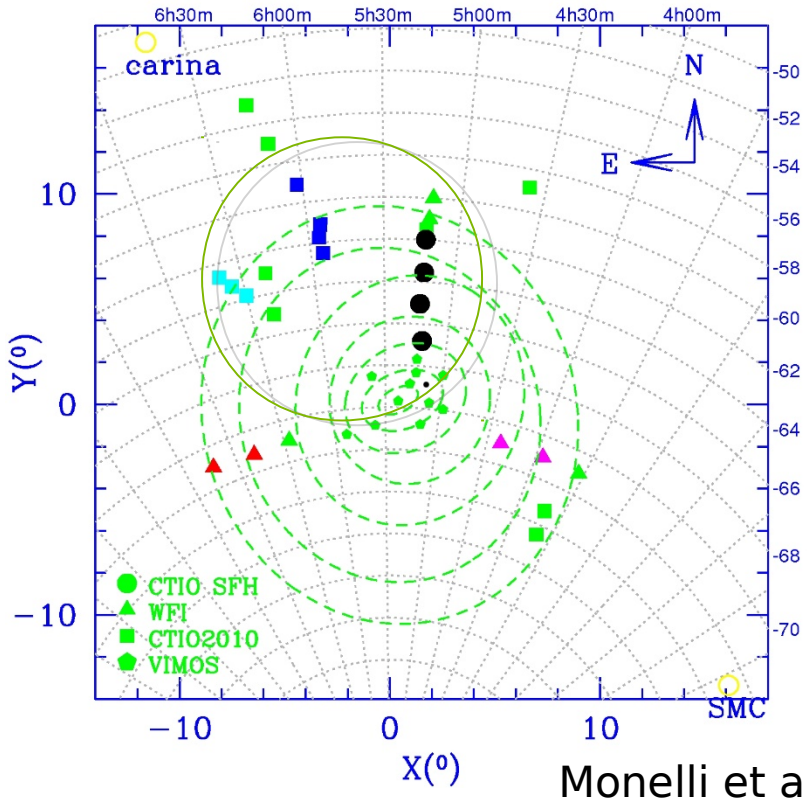
Z	Gyr
0.001	13.0
0.002	9.5
0.002	7.0
0.004	5.0
0.008	2.0
0.010	1.3
0.010	0.8
0.010	0.1

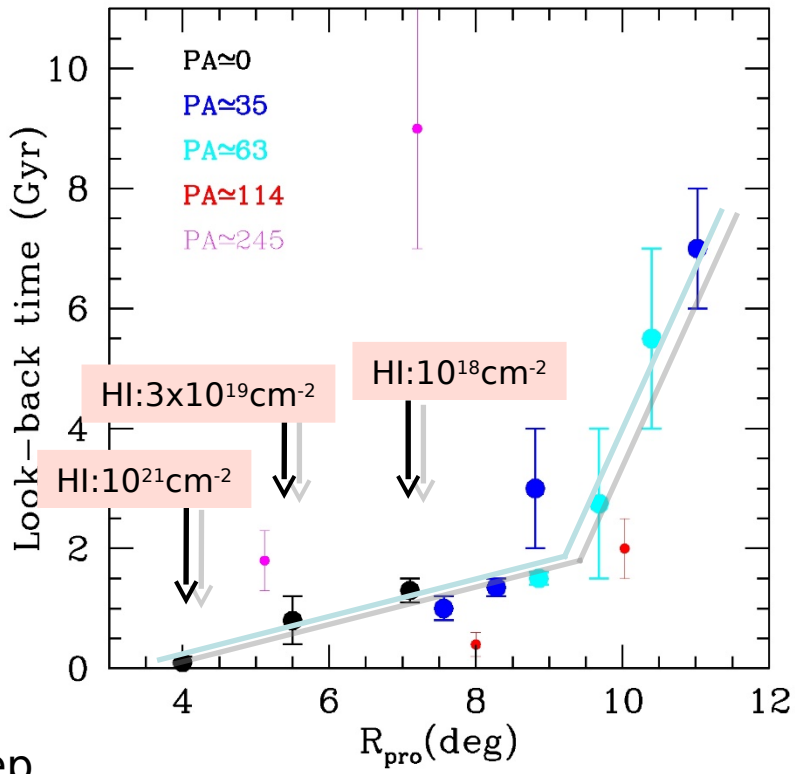
R=11º



Z	Gyr
0.001	13.0
0.002	9.5
0.002	7.0
0.004	5.0
0.008	2.0
0.010	1.3
0.010	0.8
0.010	0.1

SFH of the LMC: gradients in the disk



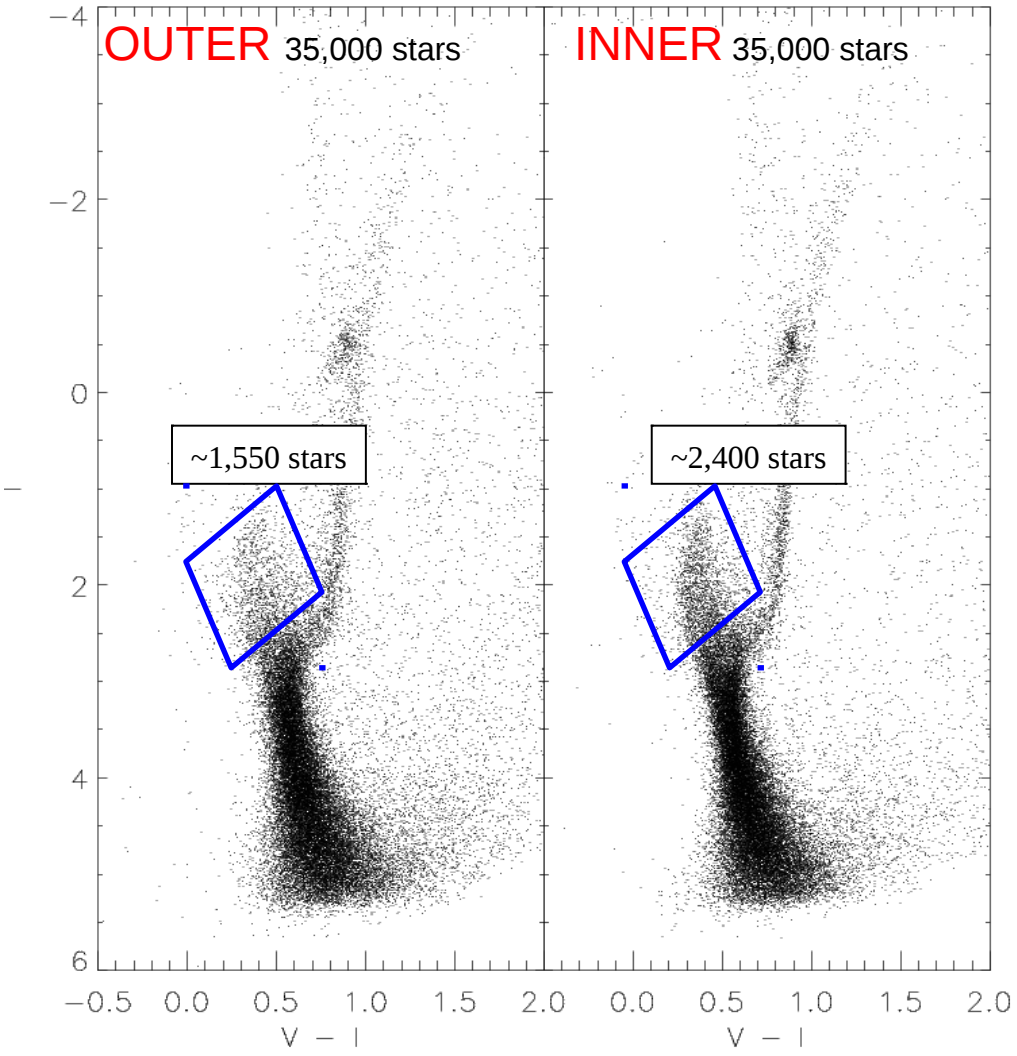


Monelli et al. in prep

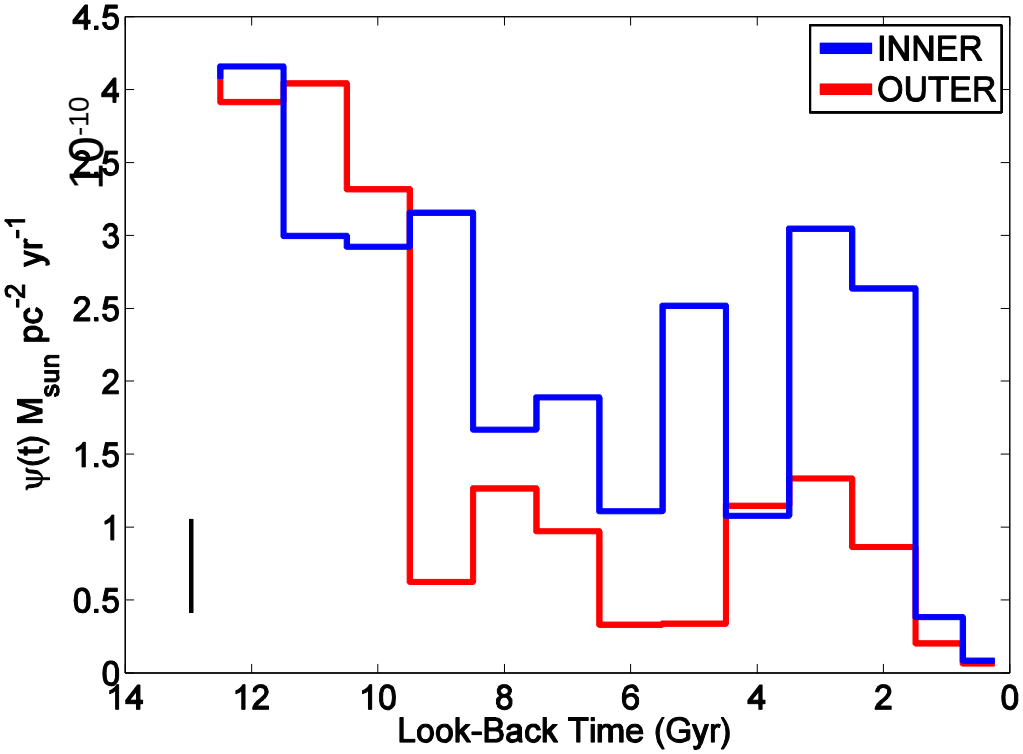
Same migration rate of ≈ 0.4 Gyr/Kpc for the age of the end of the star formation out to ≈9 Kpc

SFH of the LMC: SHARP gradients in the disk

Gallart et al 2004 showed a strong gradient in the young stellar population present in the 7.8 deg field. This suggests an abrupt change occurring on very small spatial scale

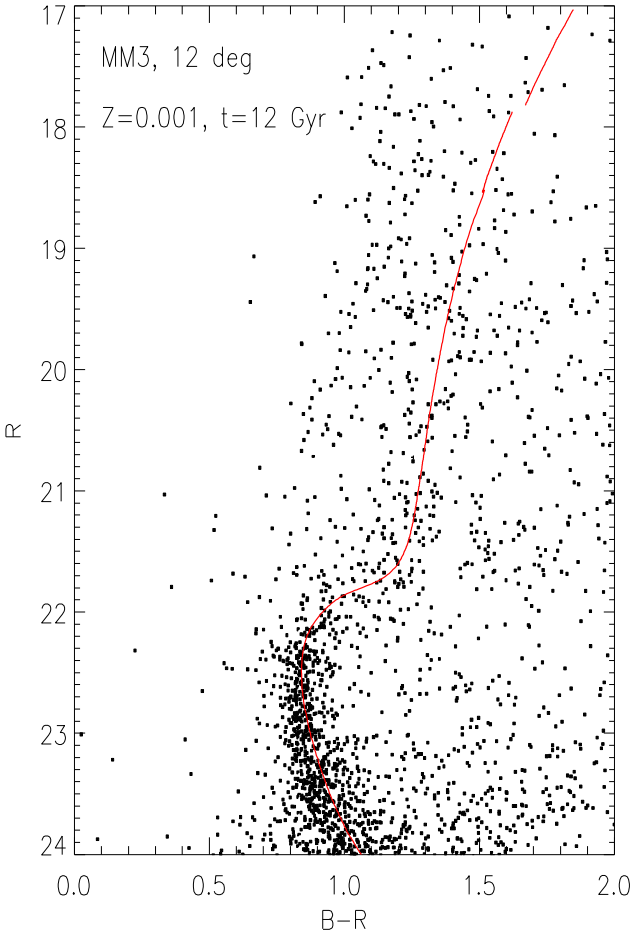


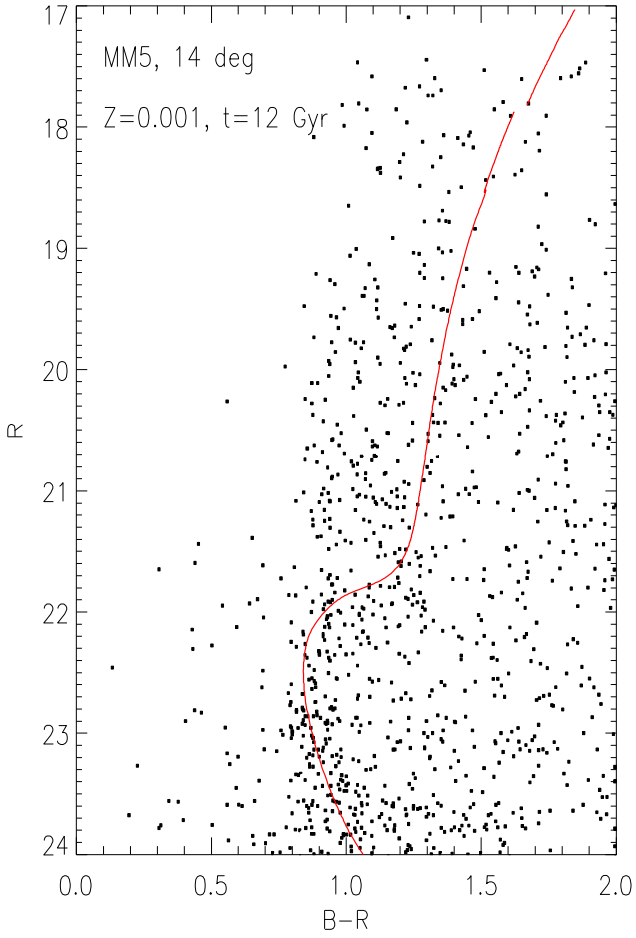
SFH of the LMC: SHARP gradients in the disk

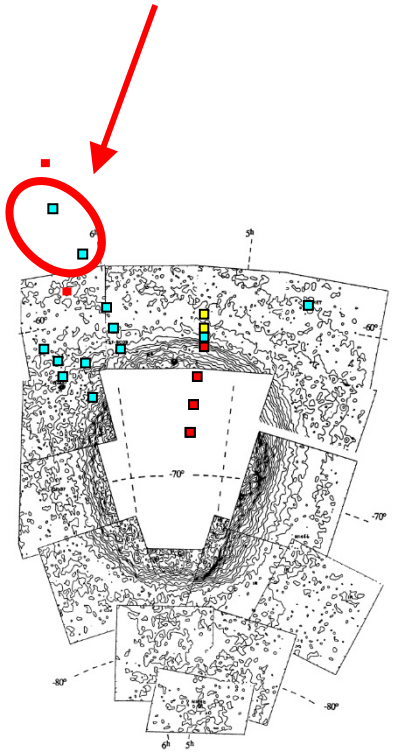


Similarities at old epoch, but the star formation at young epoch is significantly stronger in the inner region

The outermost fields

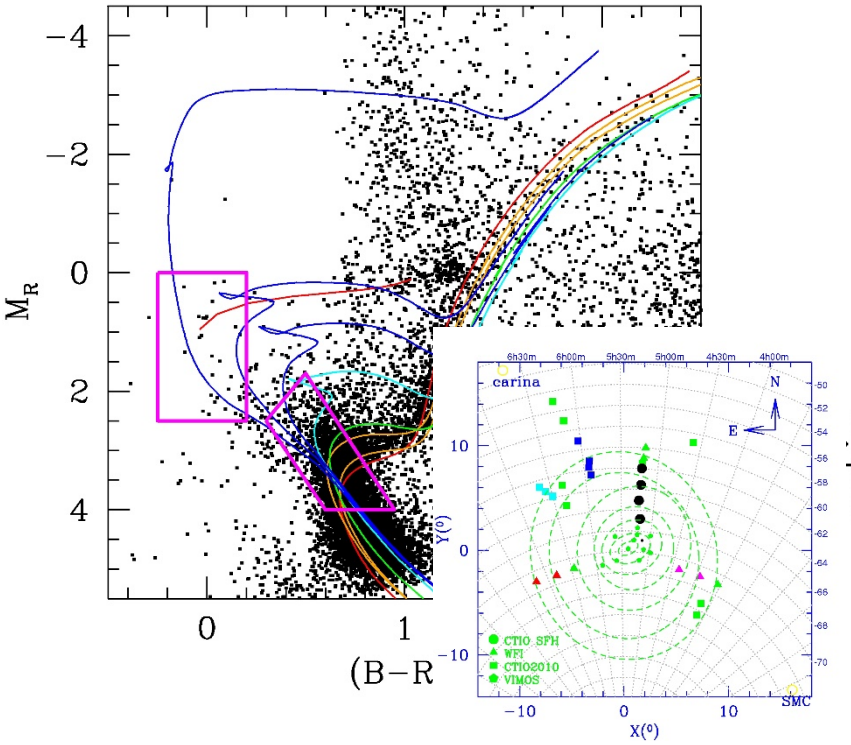




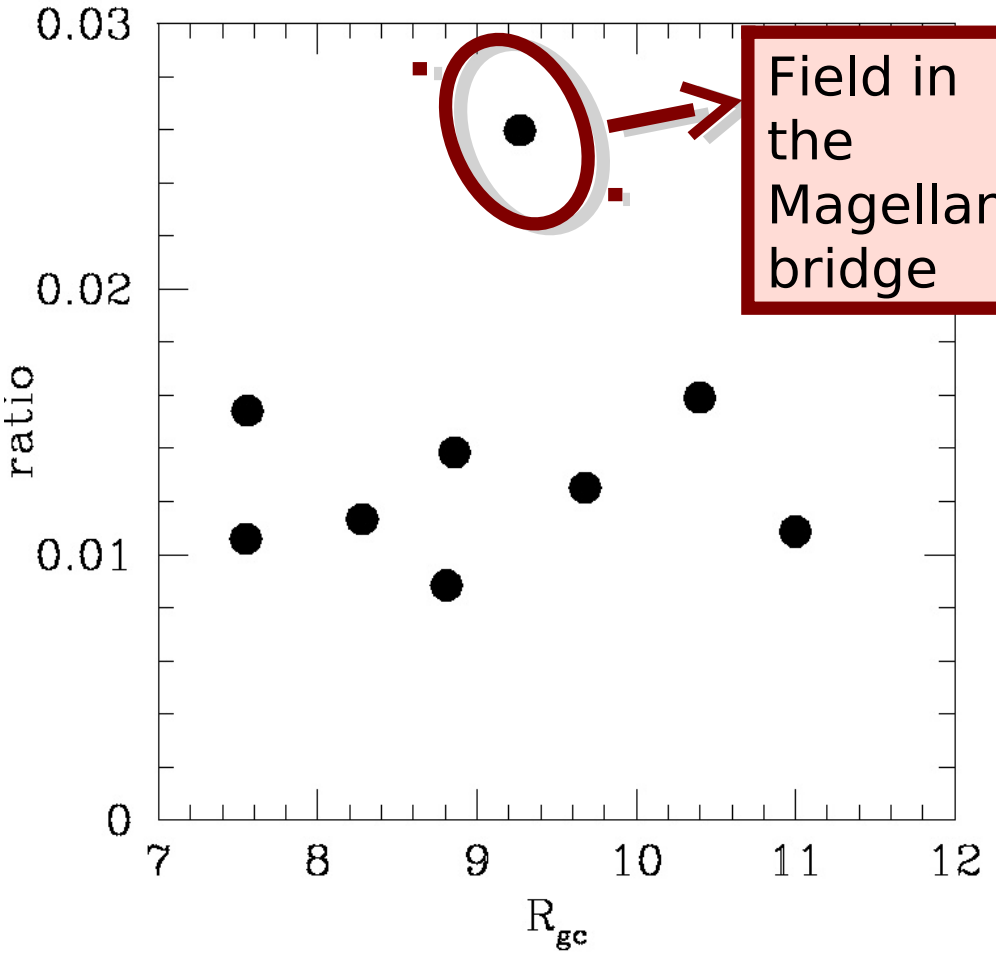


Stars of the LMC are still present at ~ 14 Kpc from the center
Are we seeing a halo-like structure? How extended is it (Muñoz et al. 2006)?

An ubiquitous young population ?



The ratio of the number of ‘young ubiquitous’ stars to the number of stars in a main sequence box representative of stars of all ages, is approx. constant.



Survey of the MAgellanic Stellar History: SMASH

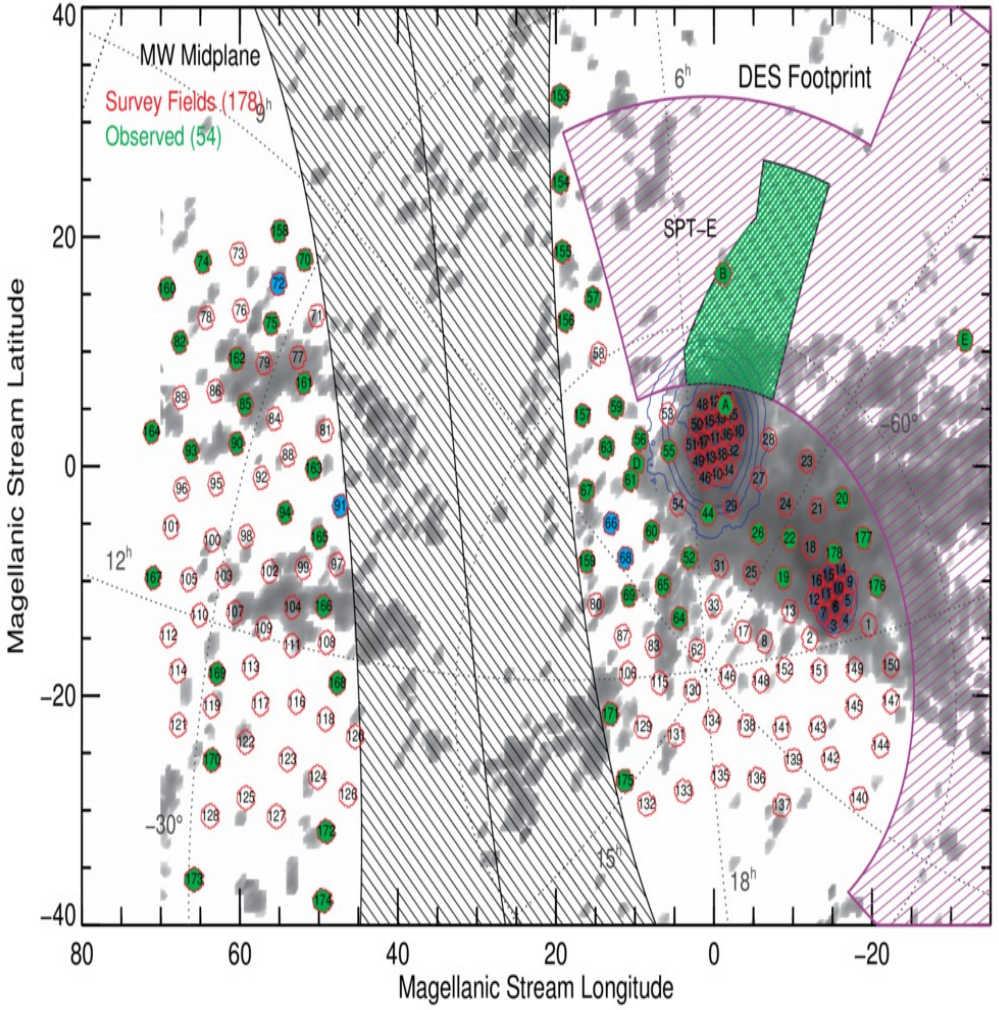
- 40 nights with CTIO/DECam
- 480 deg^2 distributed over 2500 deg^2 complementary to DES footprint
- ugriz filters, to 24th mag
- 30 researchers, P.I. D. Nidever

GOALS:

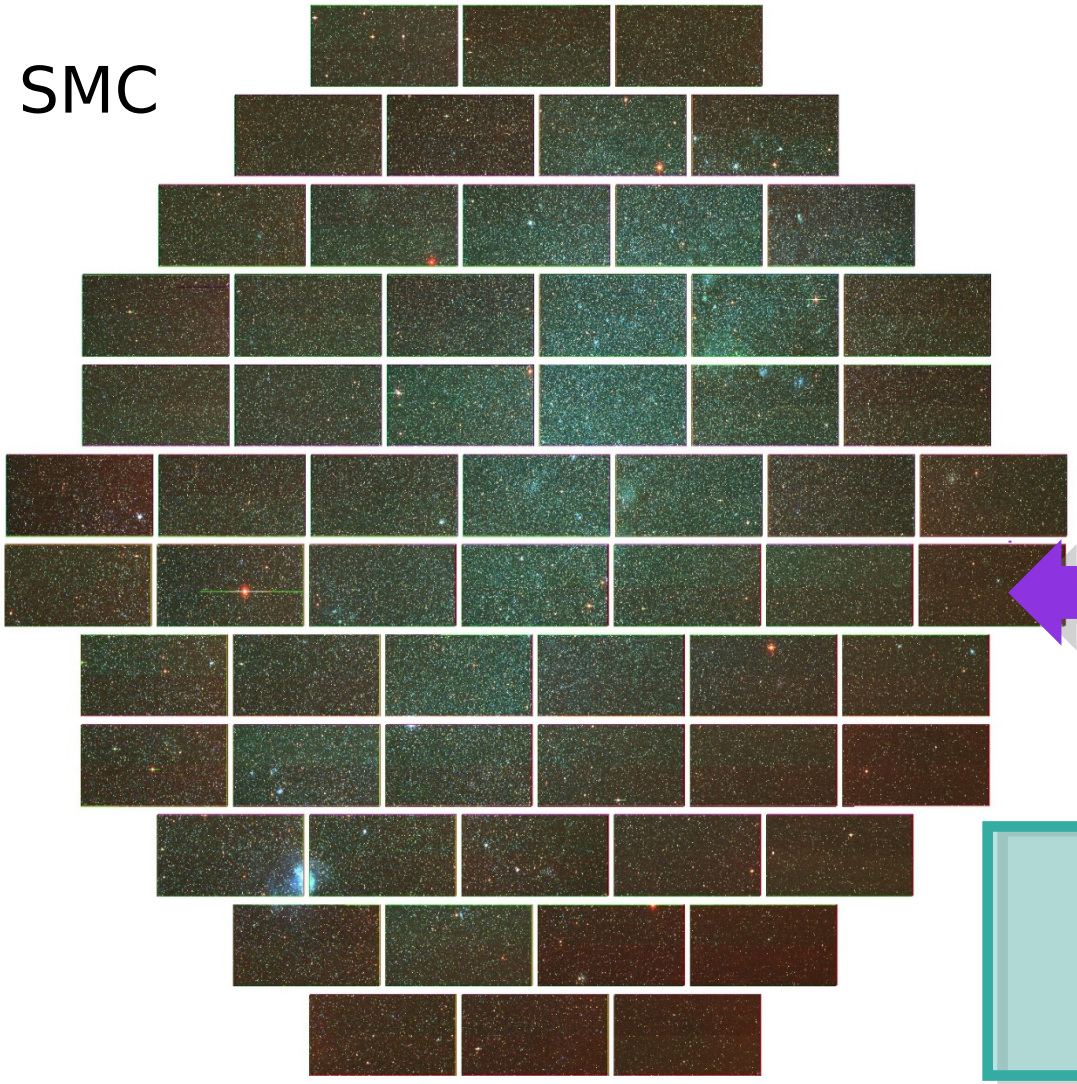
-Map the Magellanic stellar periphery with old main-sequence turnoff stars revealing relics of their formation and past interactions

- Search for the stellar component of the Magellanic Stream and Leading Arm

- Derive spatially-resolved star formation histories covering all ages out to large radii



Survey of the MAgellanic Stellar History: SMASH

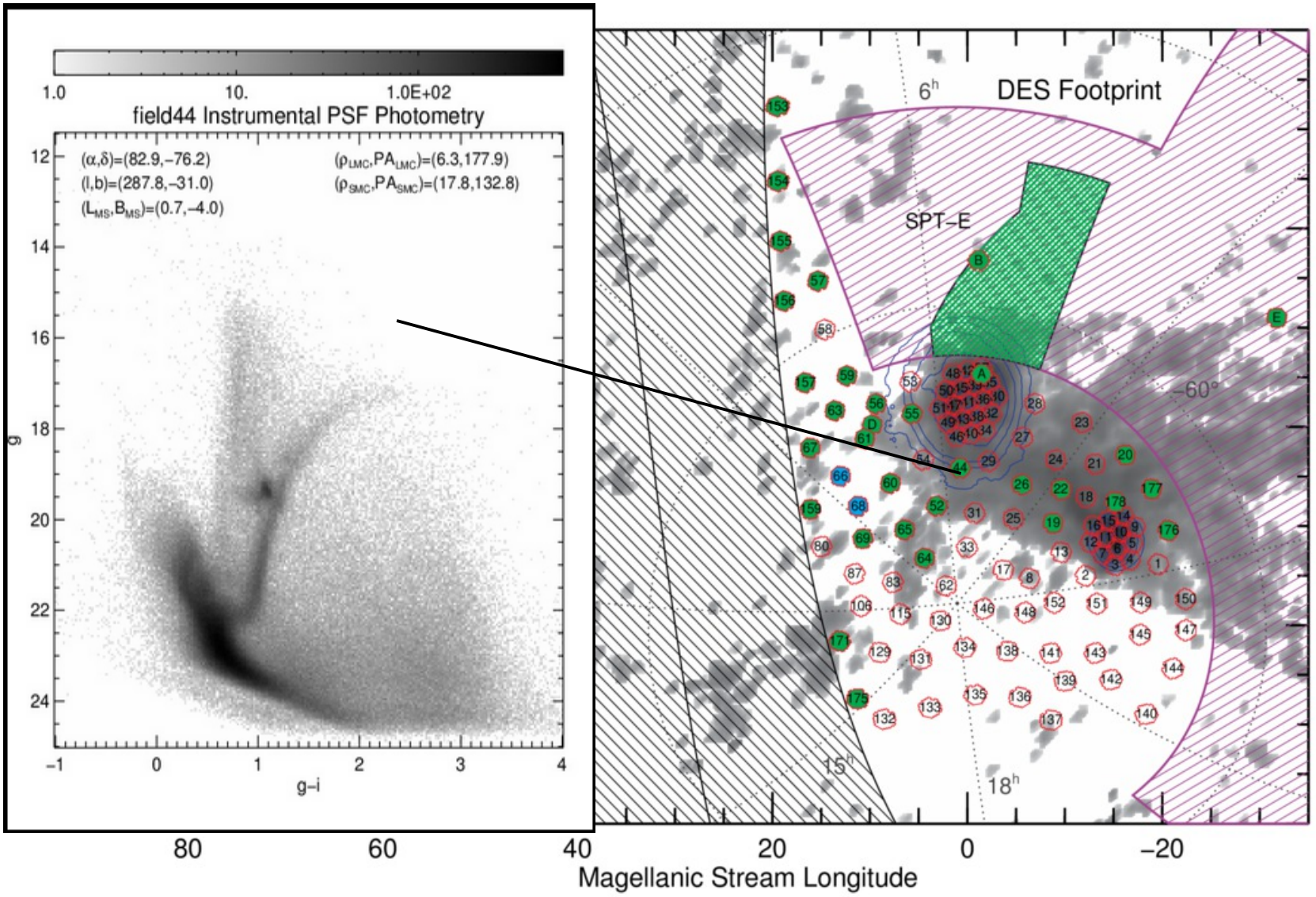


Challenges:
- 62 CCDs
- 1 image = 2 Gb
- 1 field > 50 Gb
  and milions of sources
-artificial stars tests!!!!
-field contamination

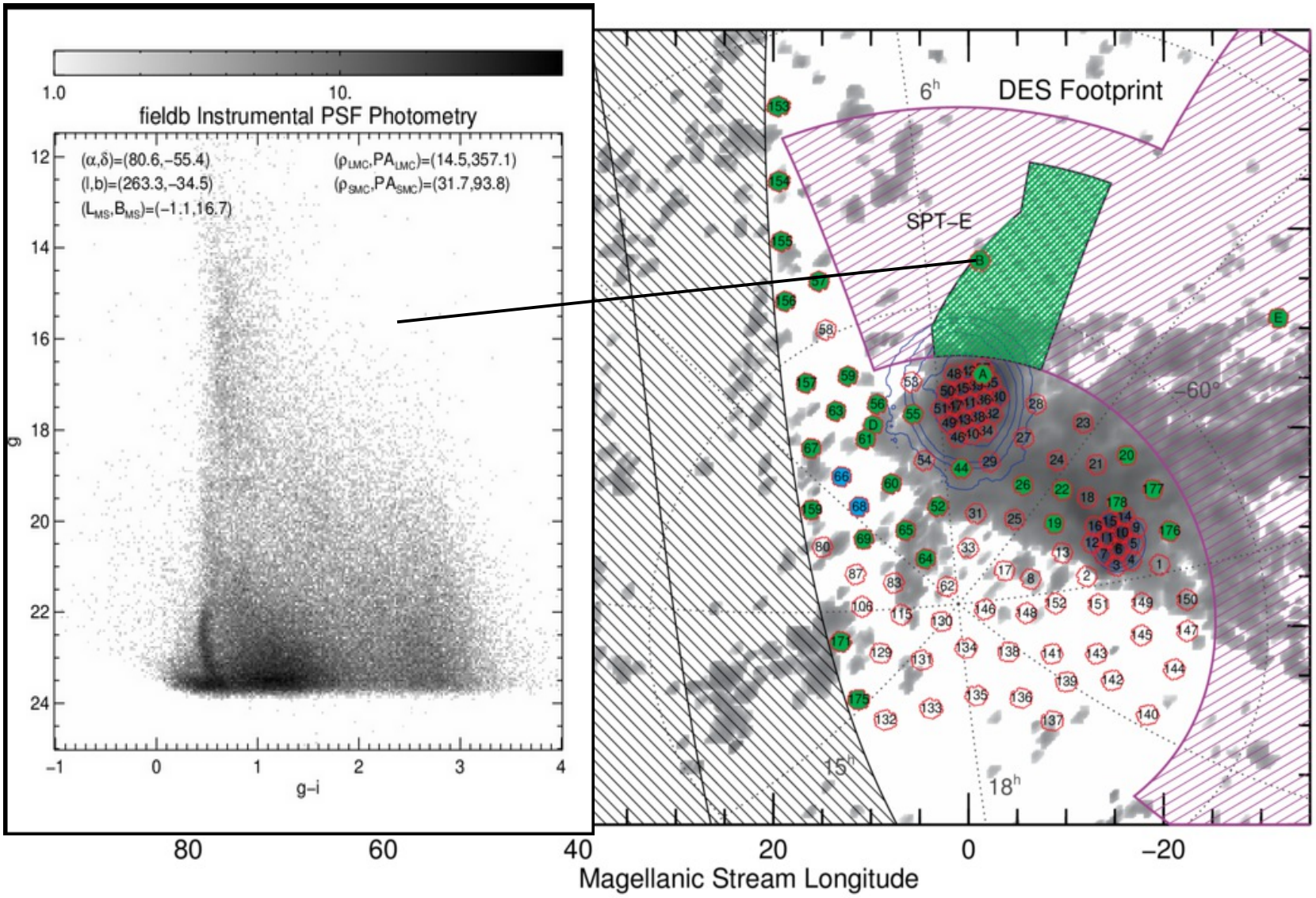
DECam@4mCTIO

Former
35'x35'detectors

Survey of the MAgellanic Stellar History: SMASH



Survey of the MAgellanic Stellar History: SMASH



Take-home messages

1) Strong population gradients are present in the LMC disk (r > 3 kpc): outside-in scenario

2) The age corresponding to the end of the last strong star formation event shifts (increases) by ~0.4 Gyr/kpc when moving outwards

3) A **global** vision is difficult to achieve observationally, but it is fundamental to understand the LMC evolution and gradients: the future is the SMASH survey