



Stellar Variability: from our Galaxy to the outskirts of the Local Volume

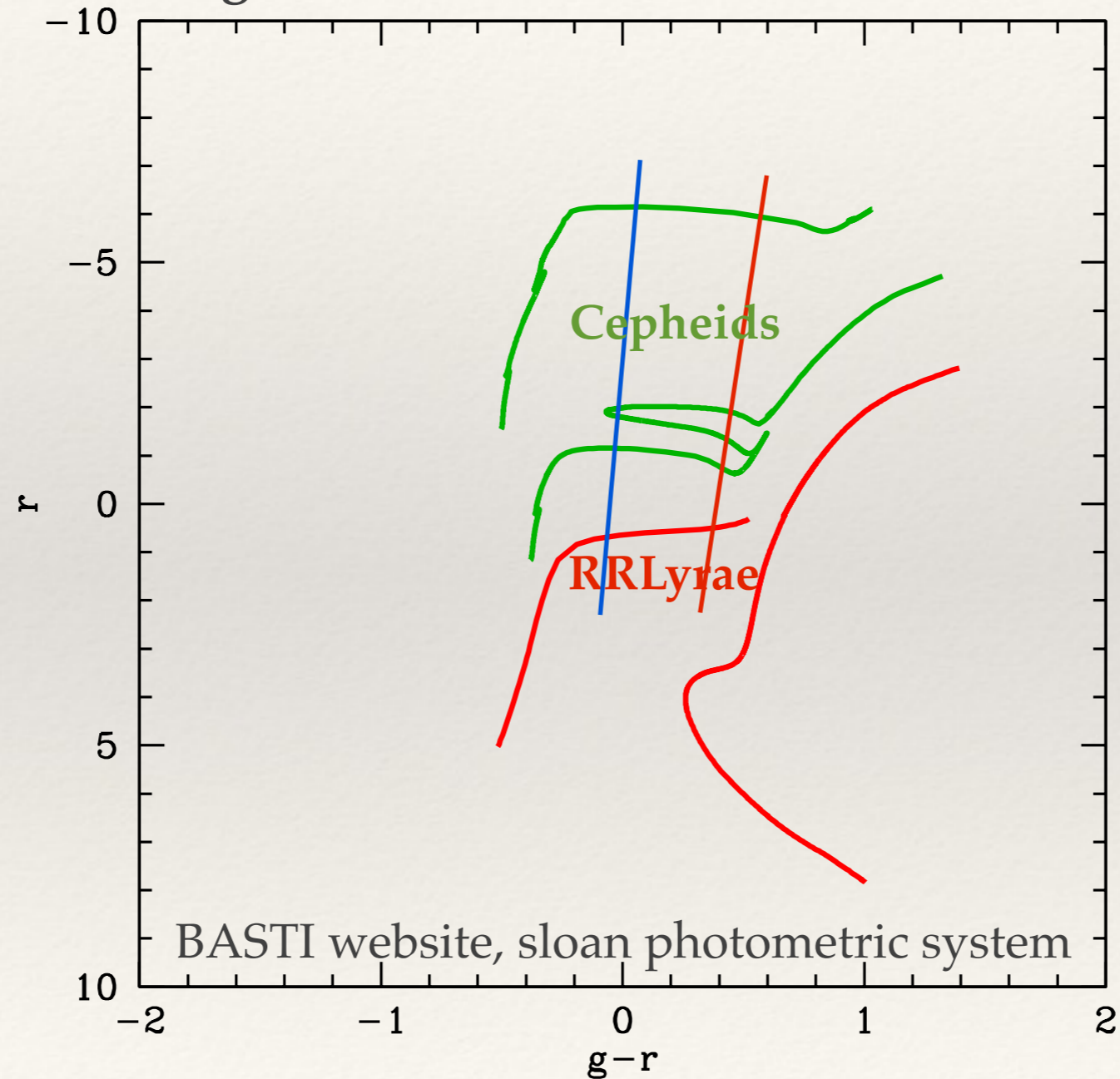
G. Fiorentino INAF-Osservatorio Astronomico di Bologna



LSST limiting magnitudes

r-band single visit ~24.5 mag

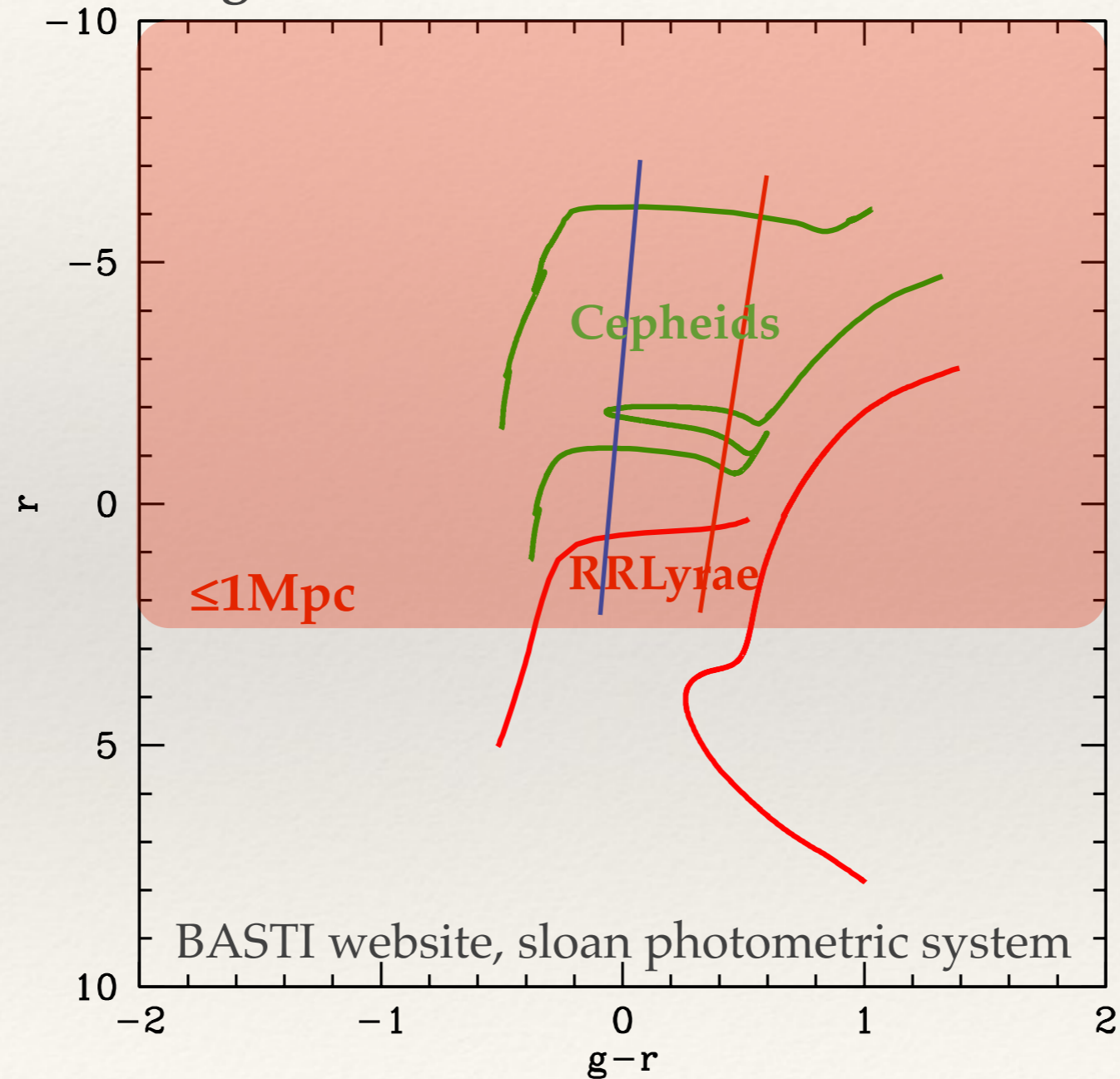
r-band end of mission ~27.5 mag



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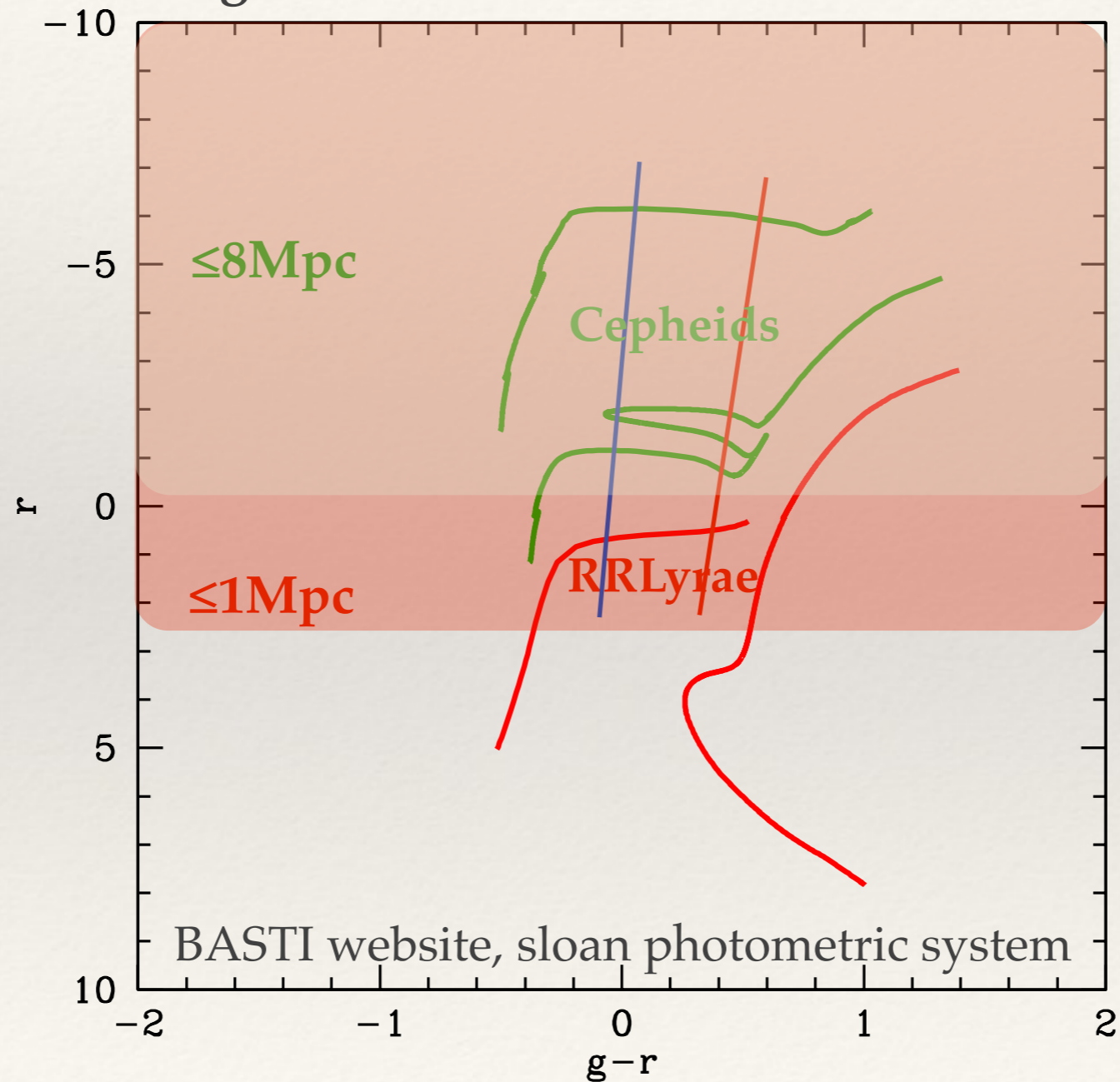
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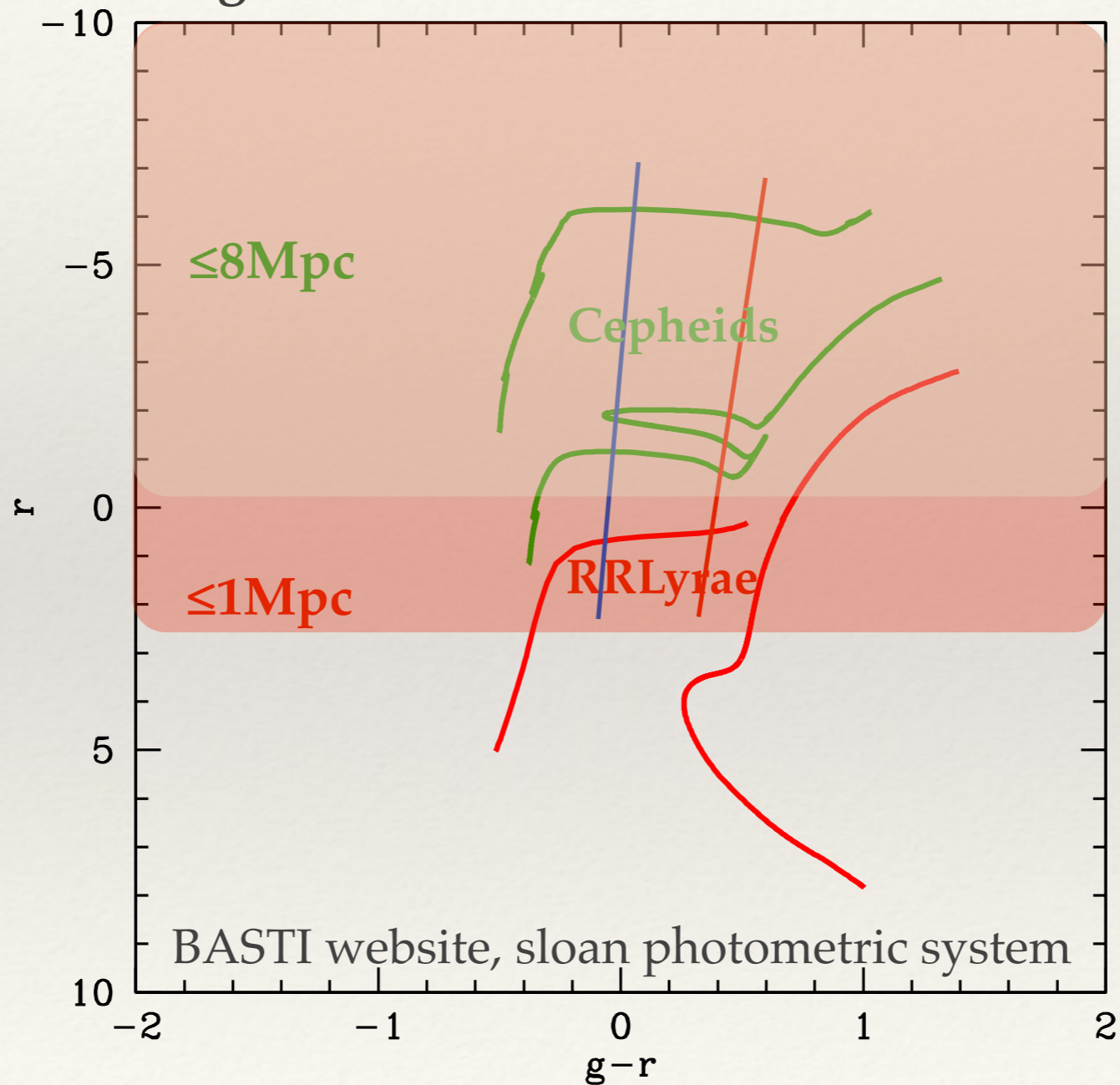
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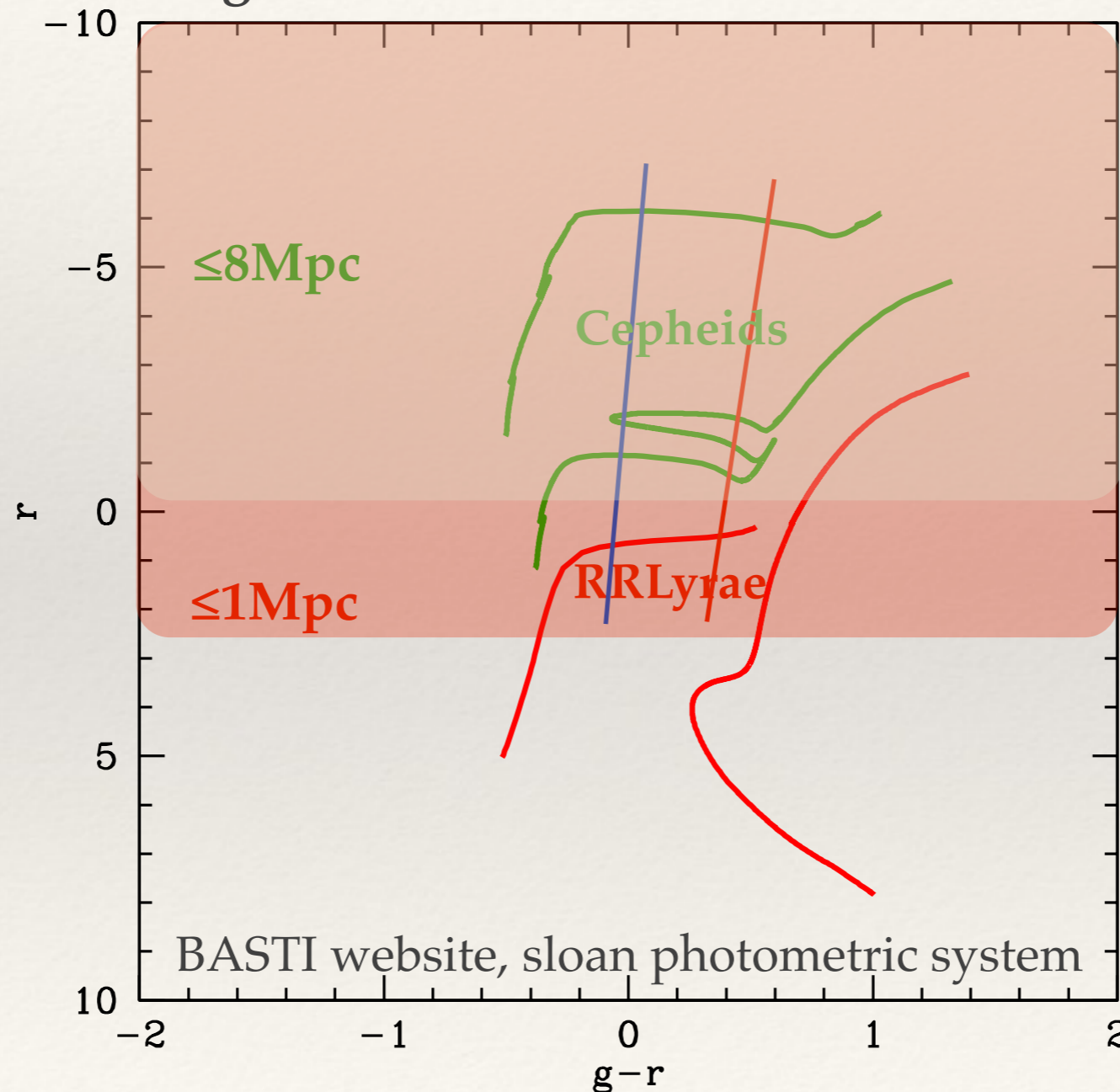


OLD pop.

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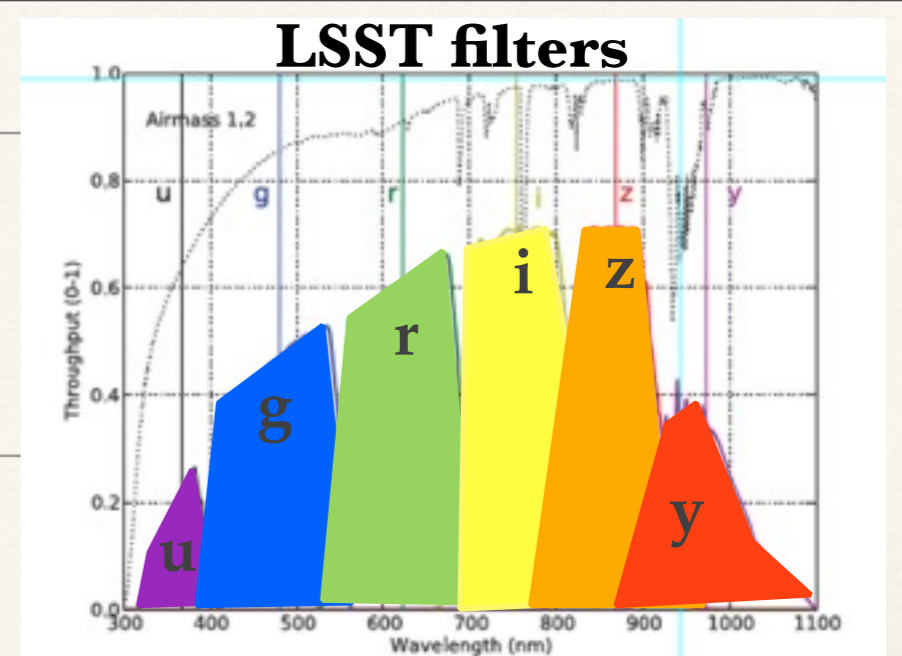
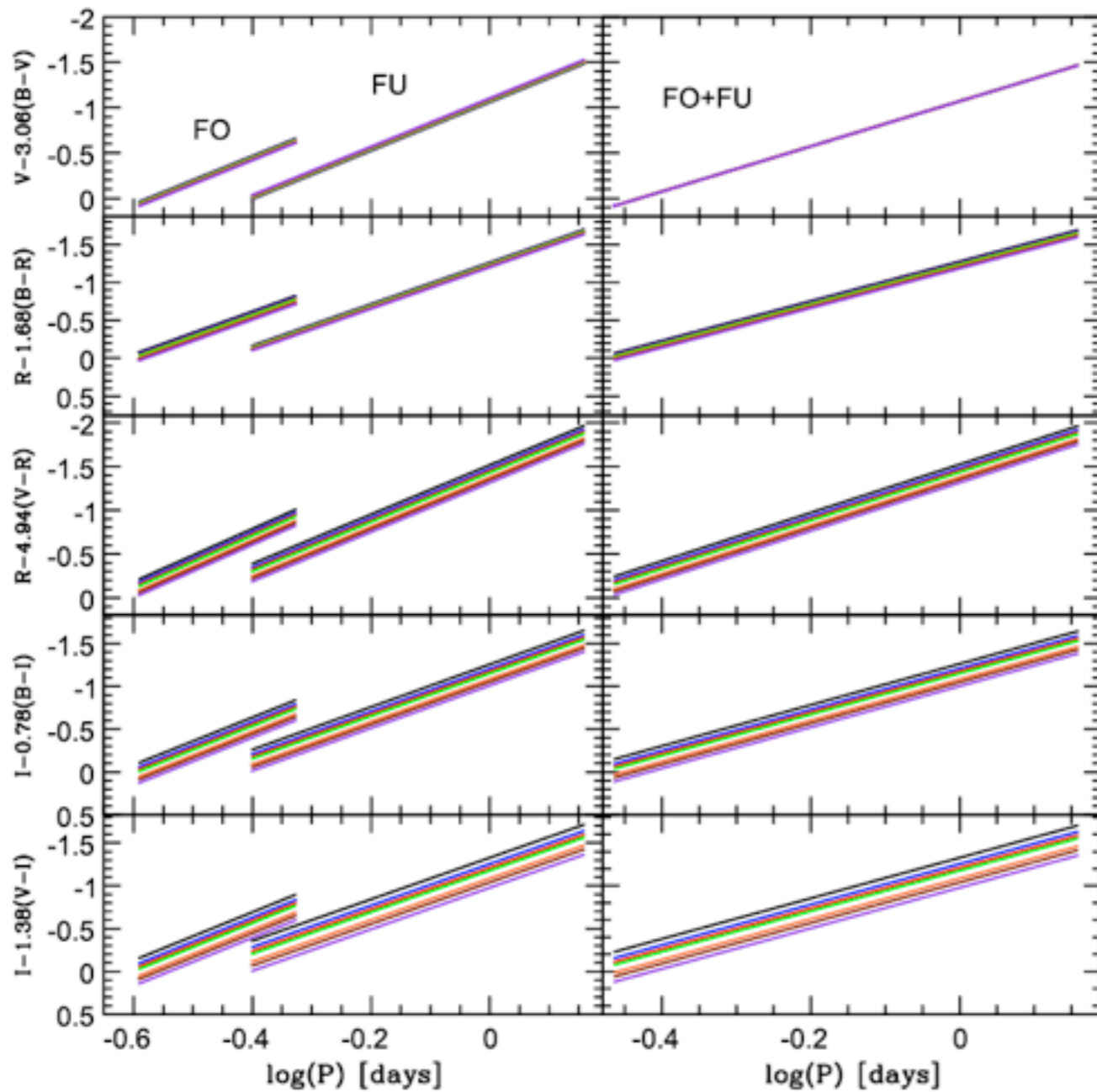
YOUNG pop.



OLD pop.

Theoretical models

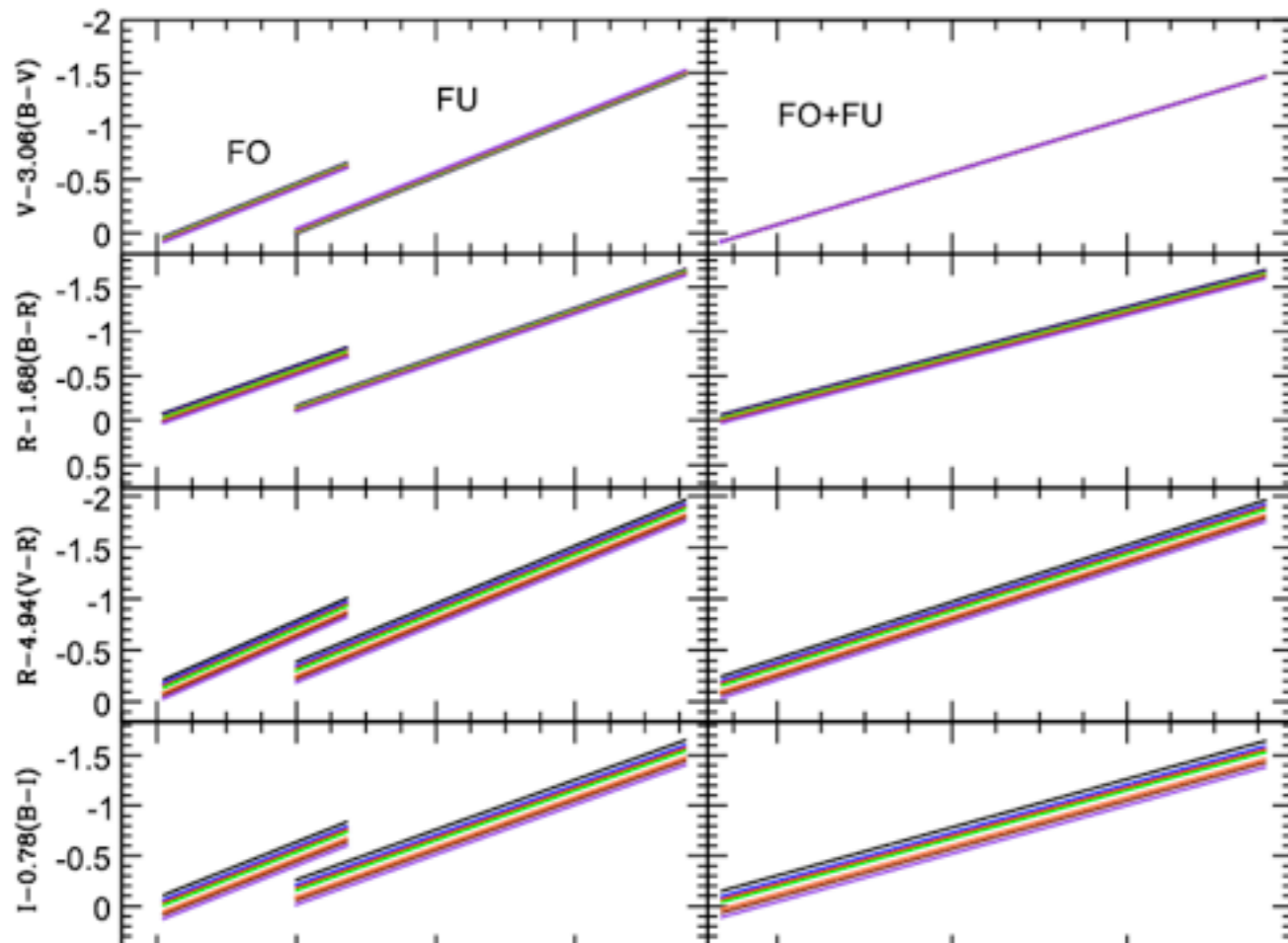
new updated scenario for RR Lyrae



Marconi et al., ApJ, 2015, 808, 50

Theoretical models

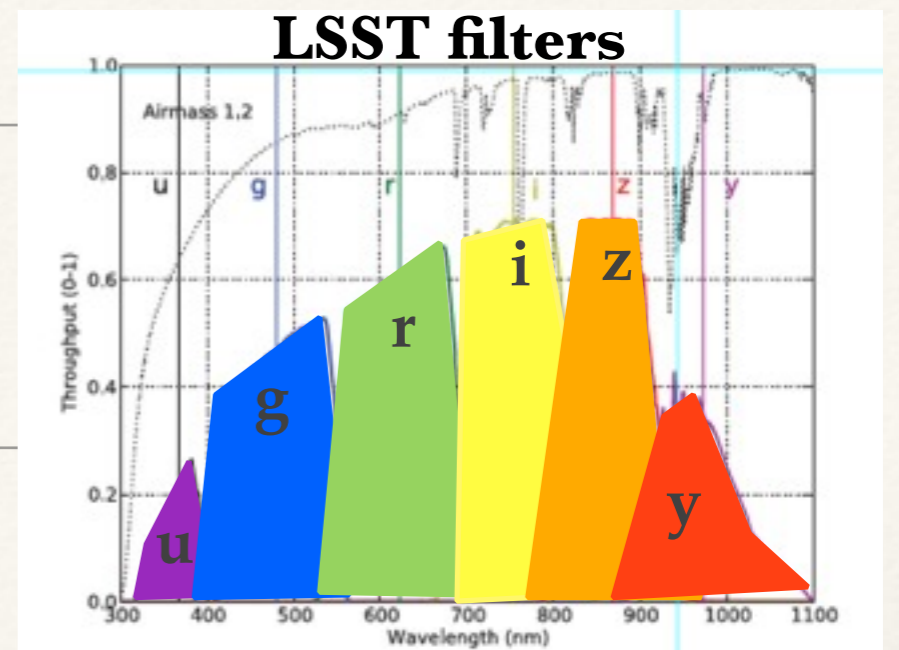
new updated scenario for RR Lyrae



PL(I) and PL(R) strongly depend on metallicity

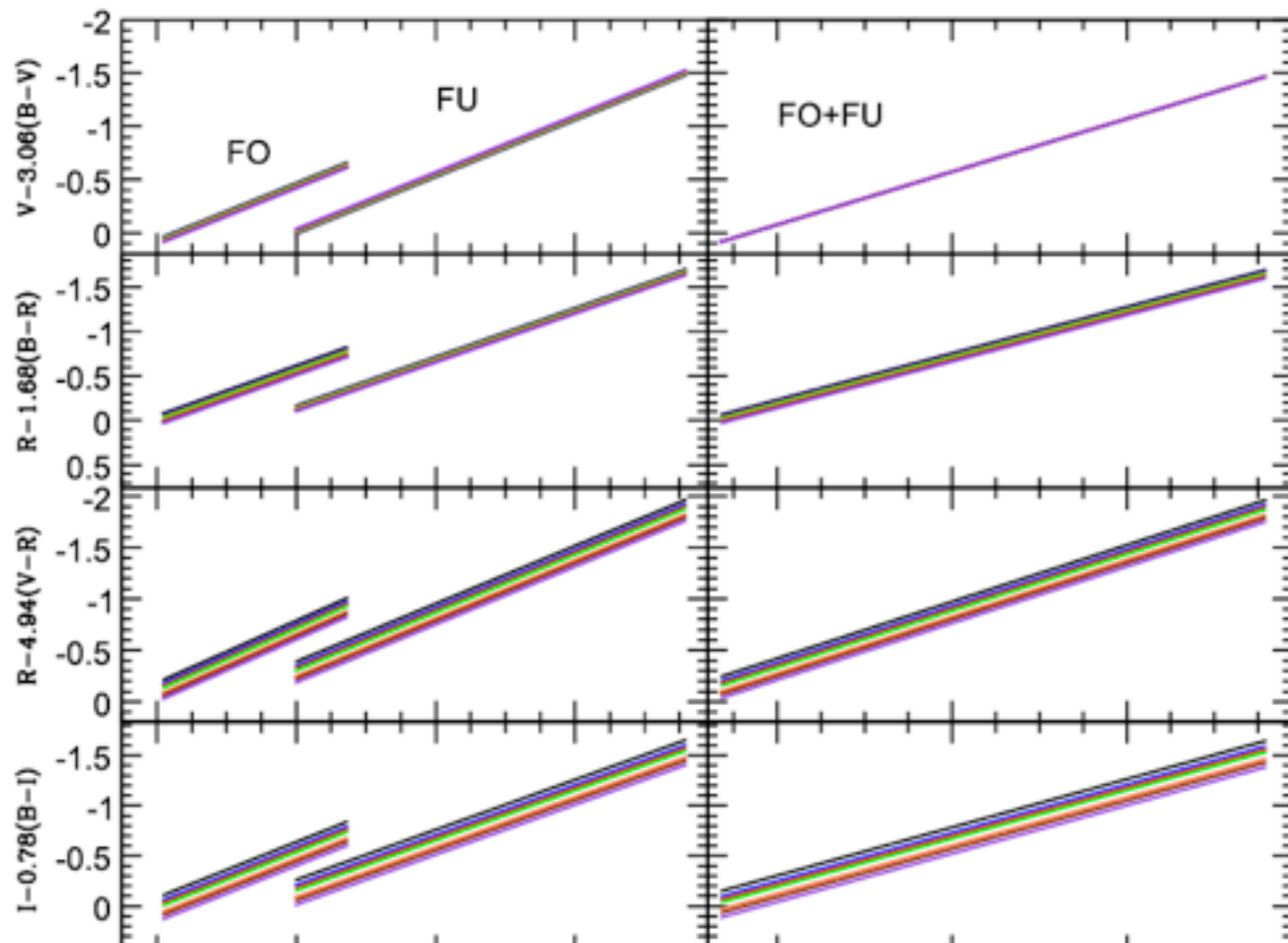
$$[\text{Fe}/\text{H}] = (M_I - \alpha - \beta \cdot \log P) / \gamma$$

Marconi et al., ApJ, 2015, 808, 50



Theoretical models

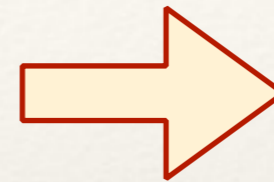
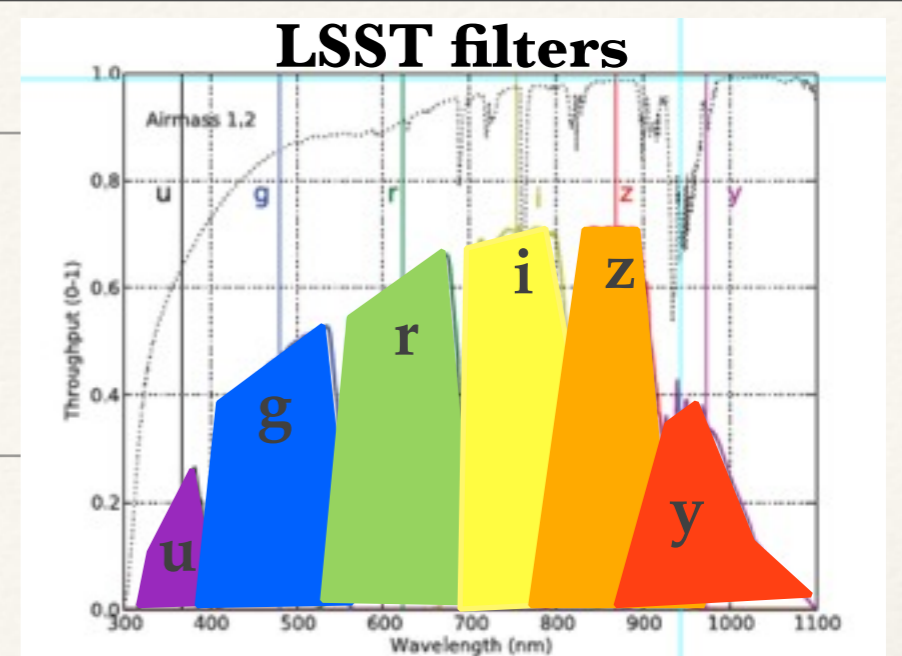
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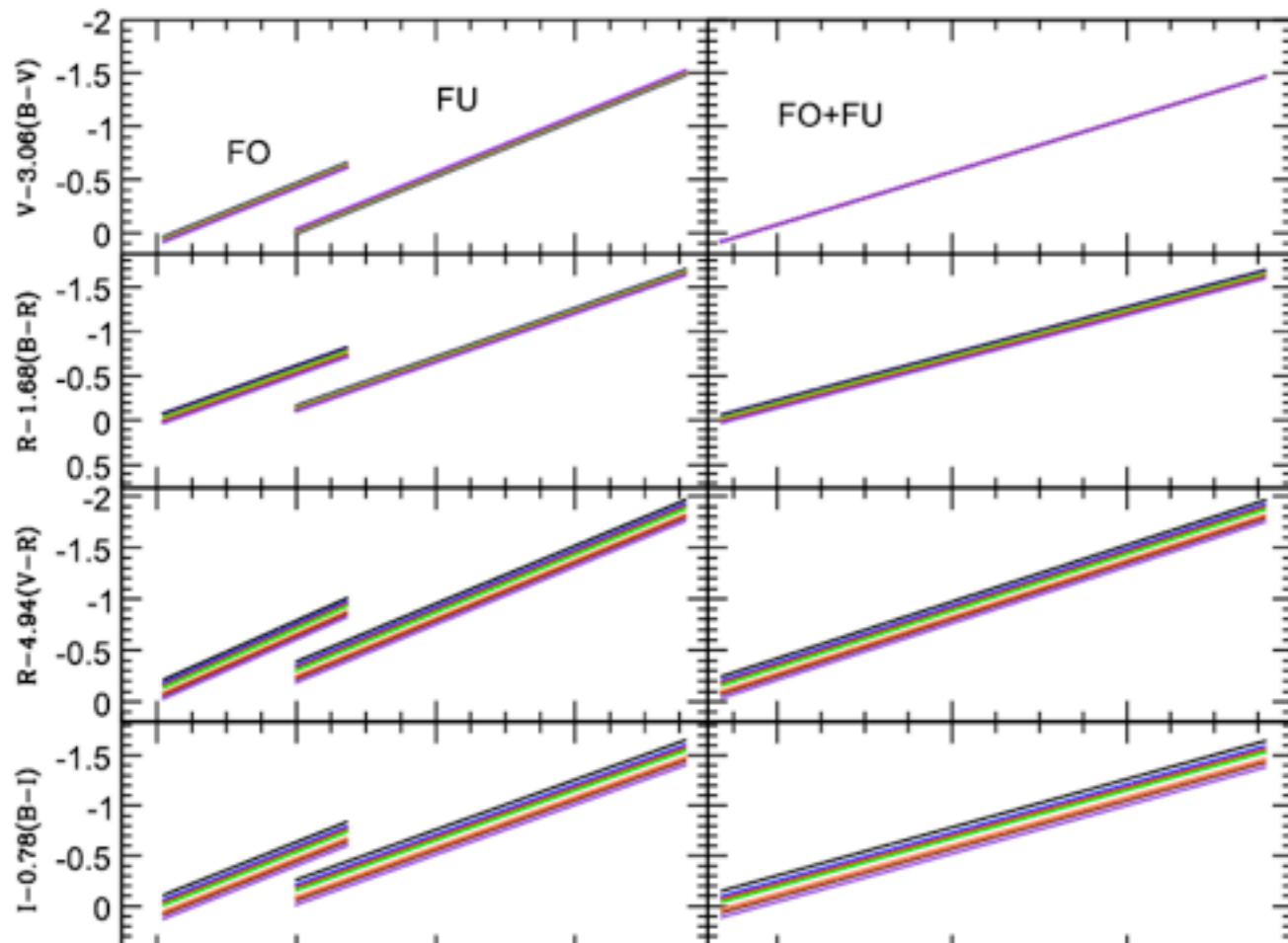
Marconi et al., ApJ, 2015, 808, 50



Distances -> 3-D structure

Theoretical models

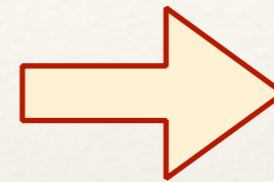
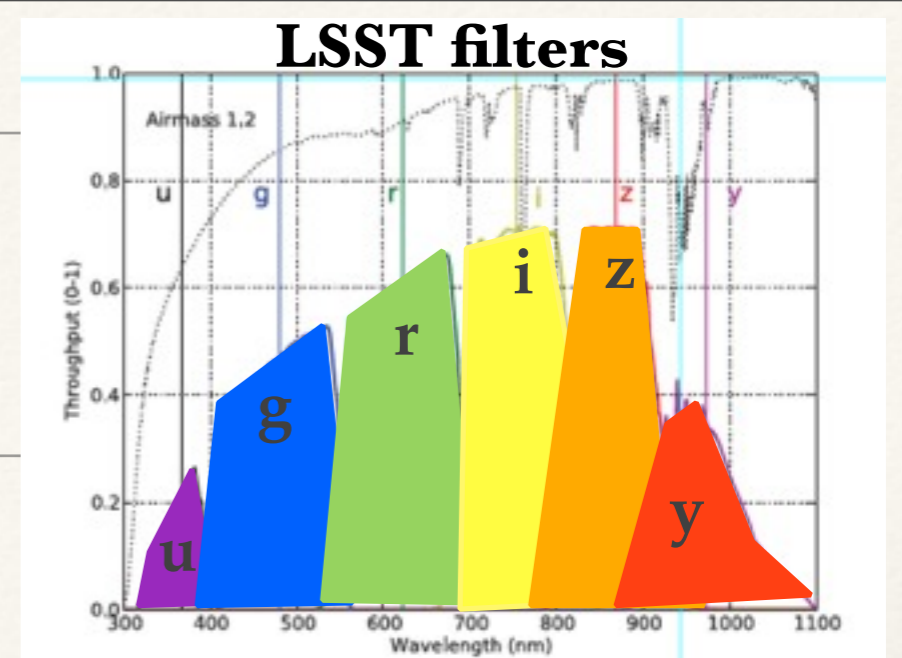
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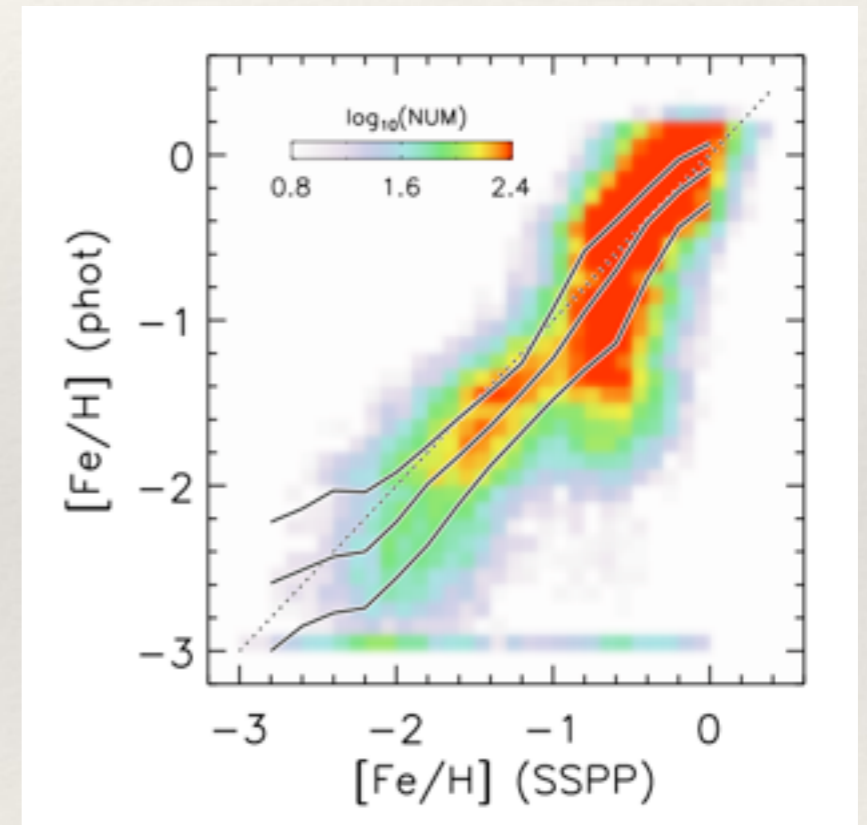
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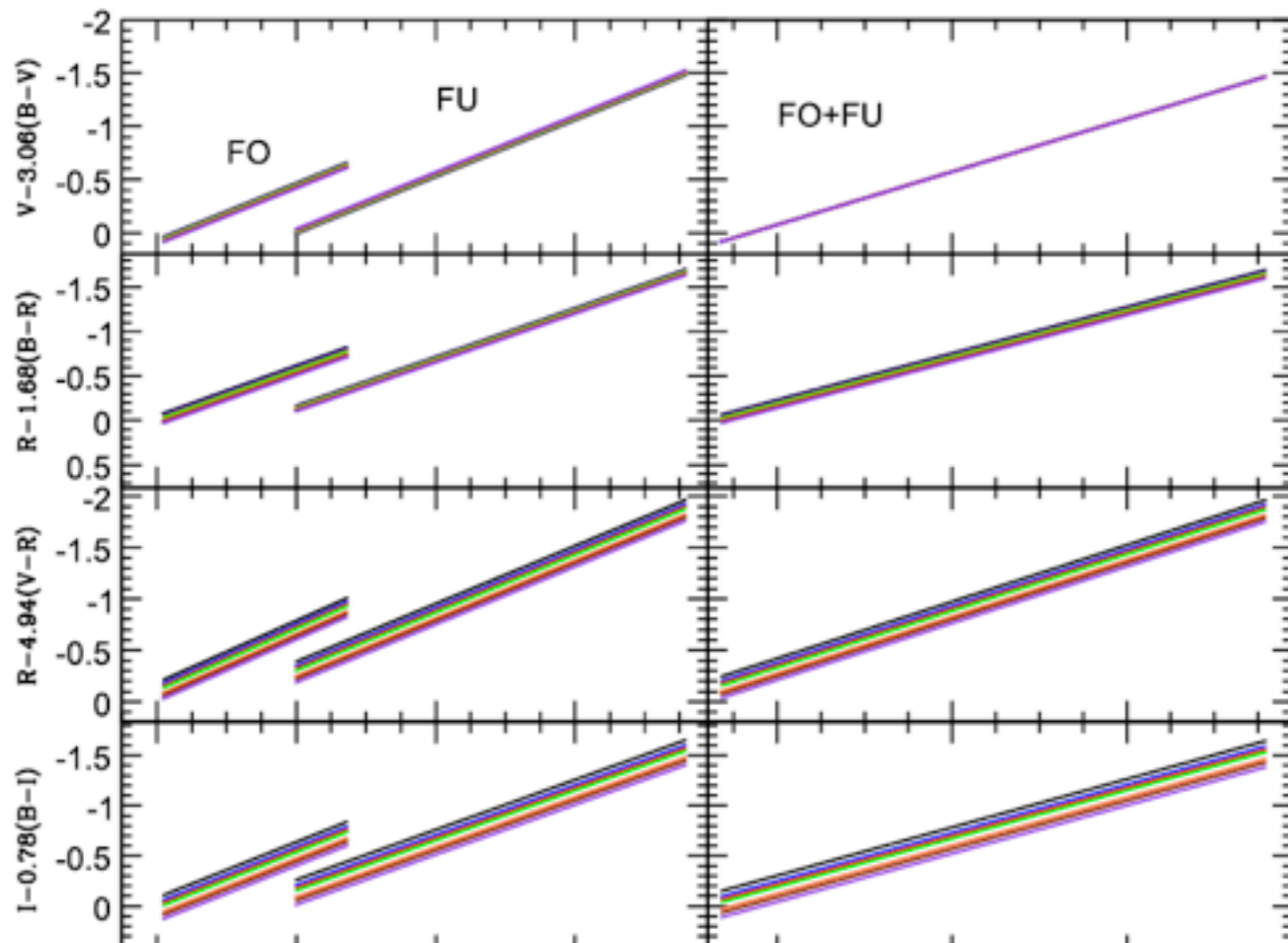
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An et al., ApJ, 2013, 763, 65

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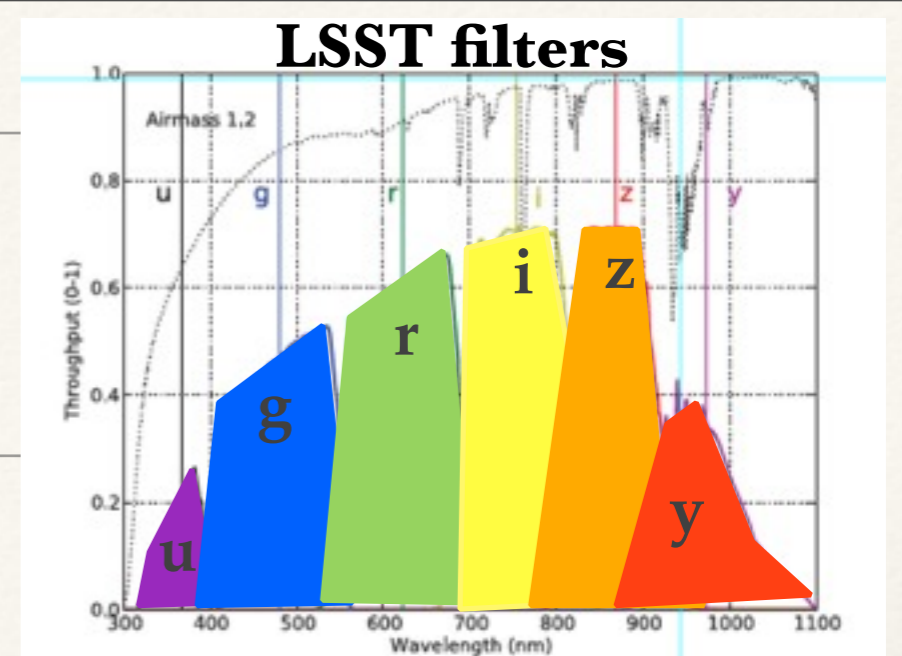
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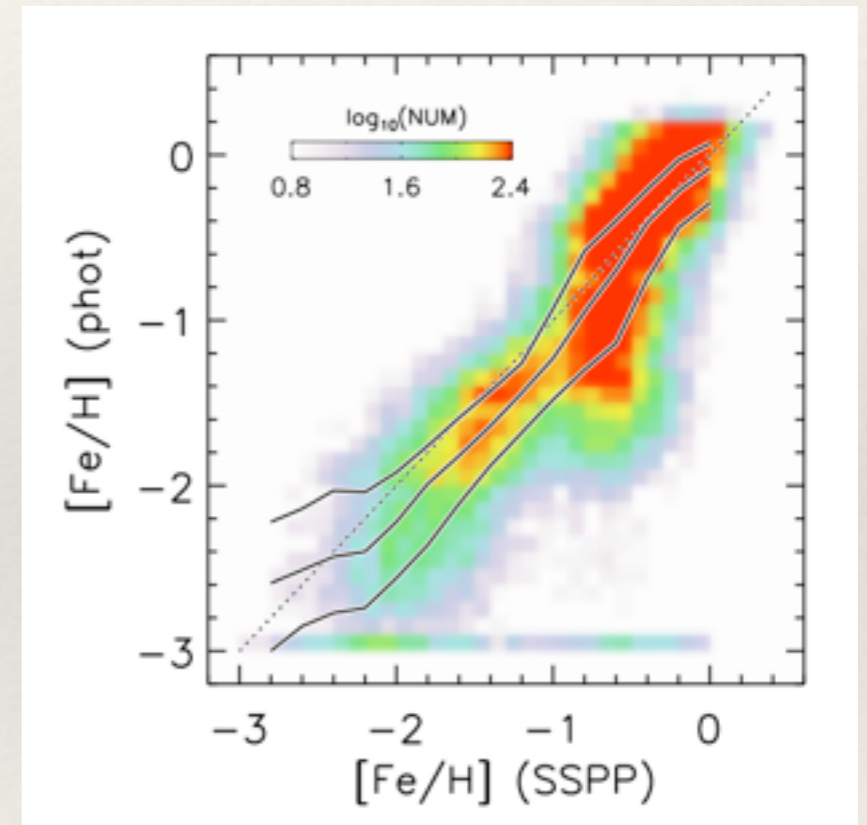
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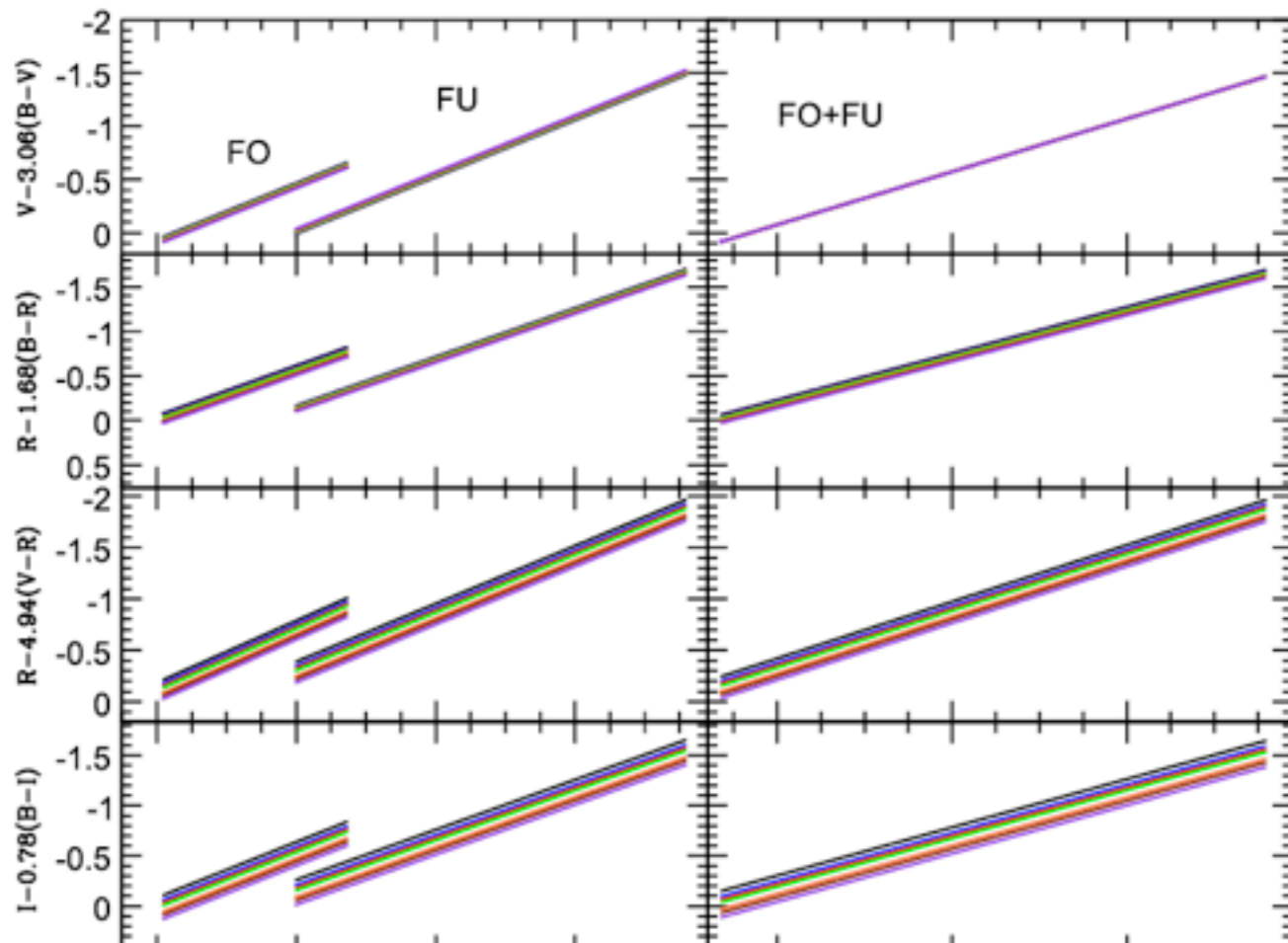


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Metallicity gradient

Theoretical models

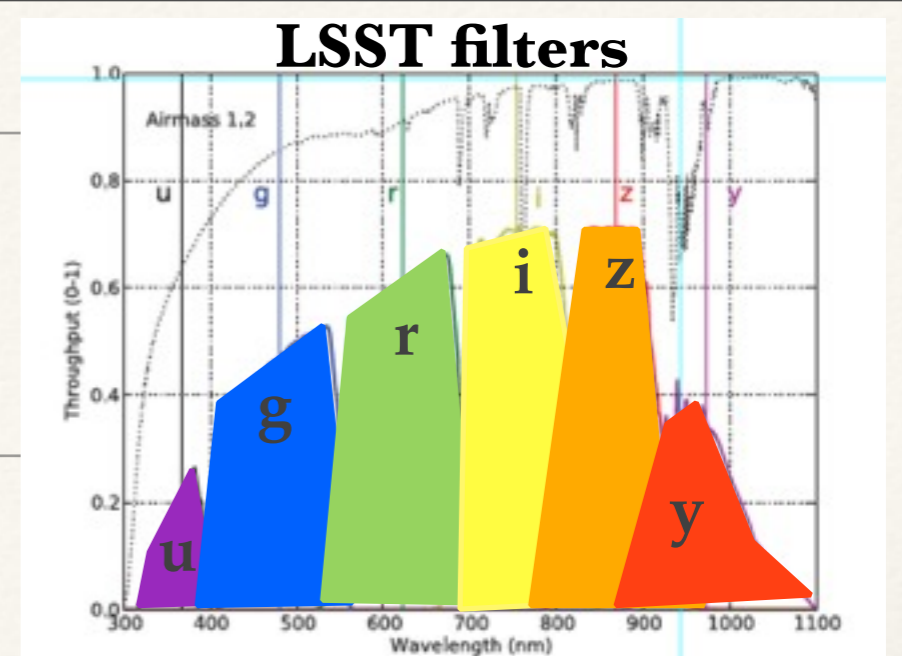
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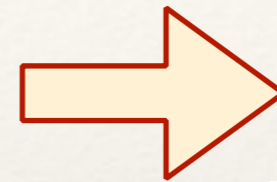
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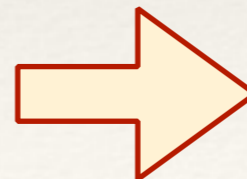


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Gaia will provide accurate calibration for these relations within few Kpc, ($\sigma_{\pi}/\pi < 5\%$) !!! (see Clementini & Vallenari's talk)

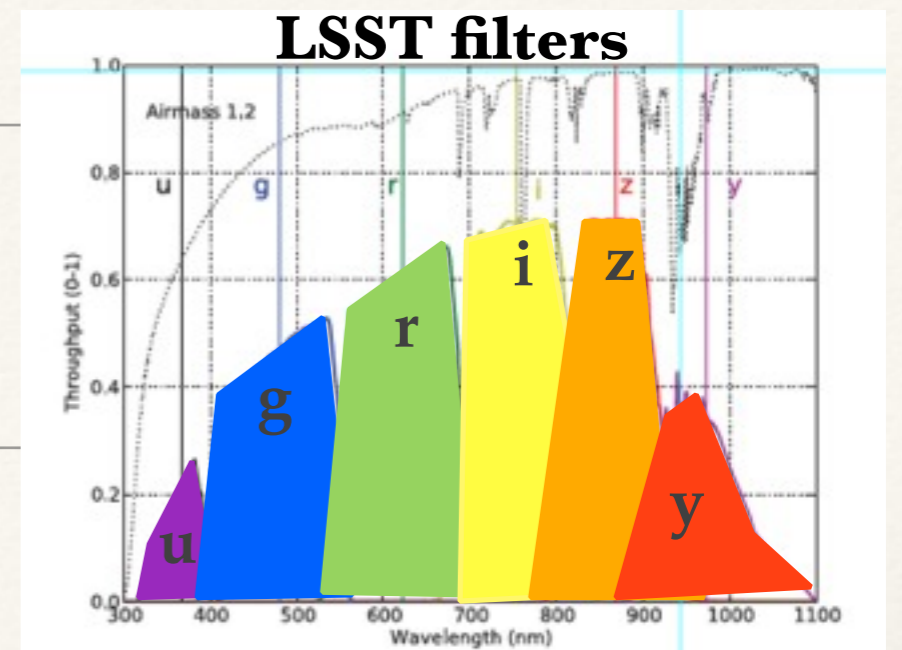
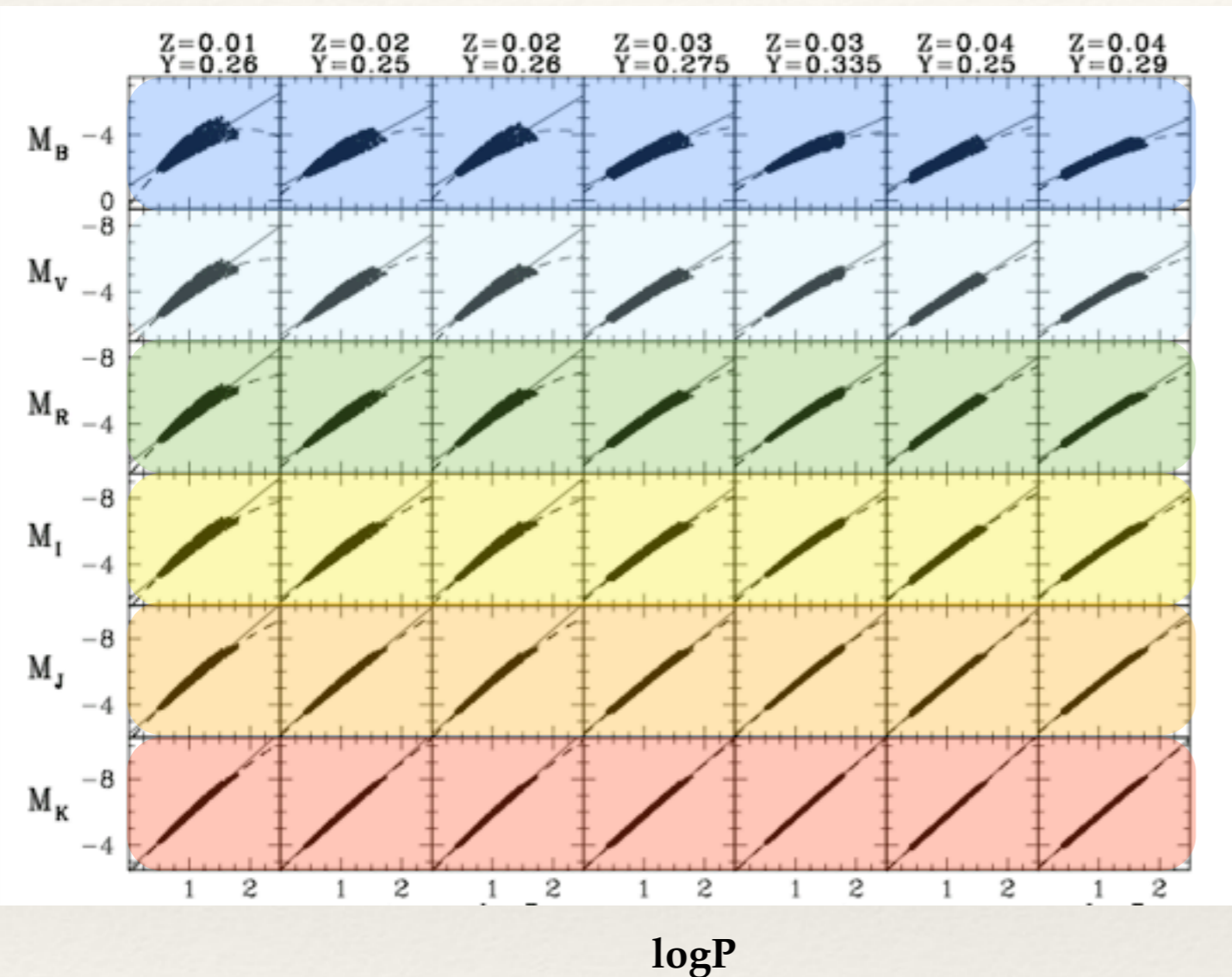
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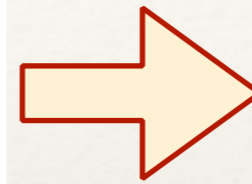
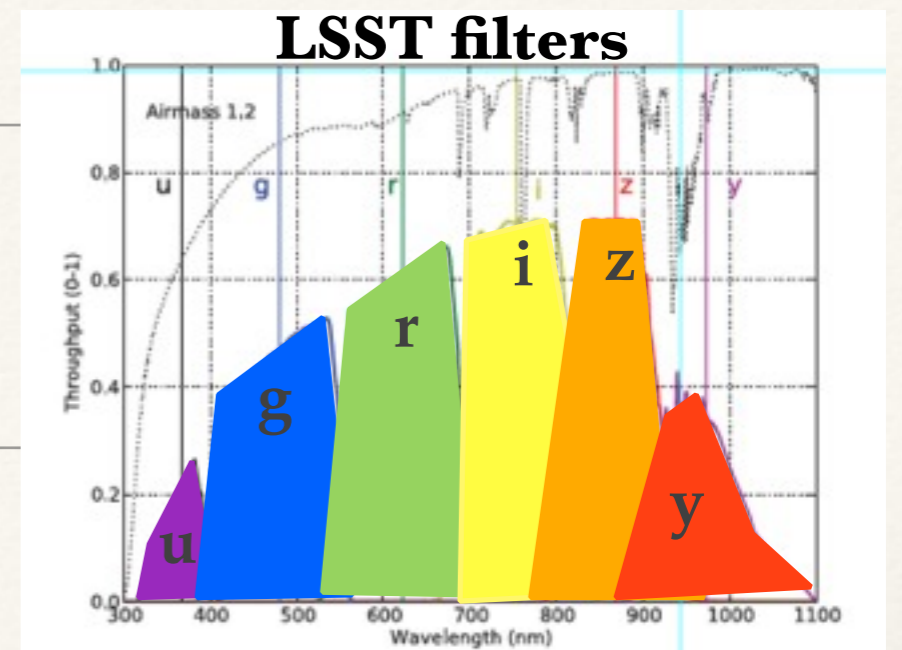
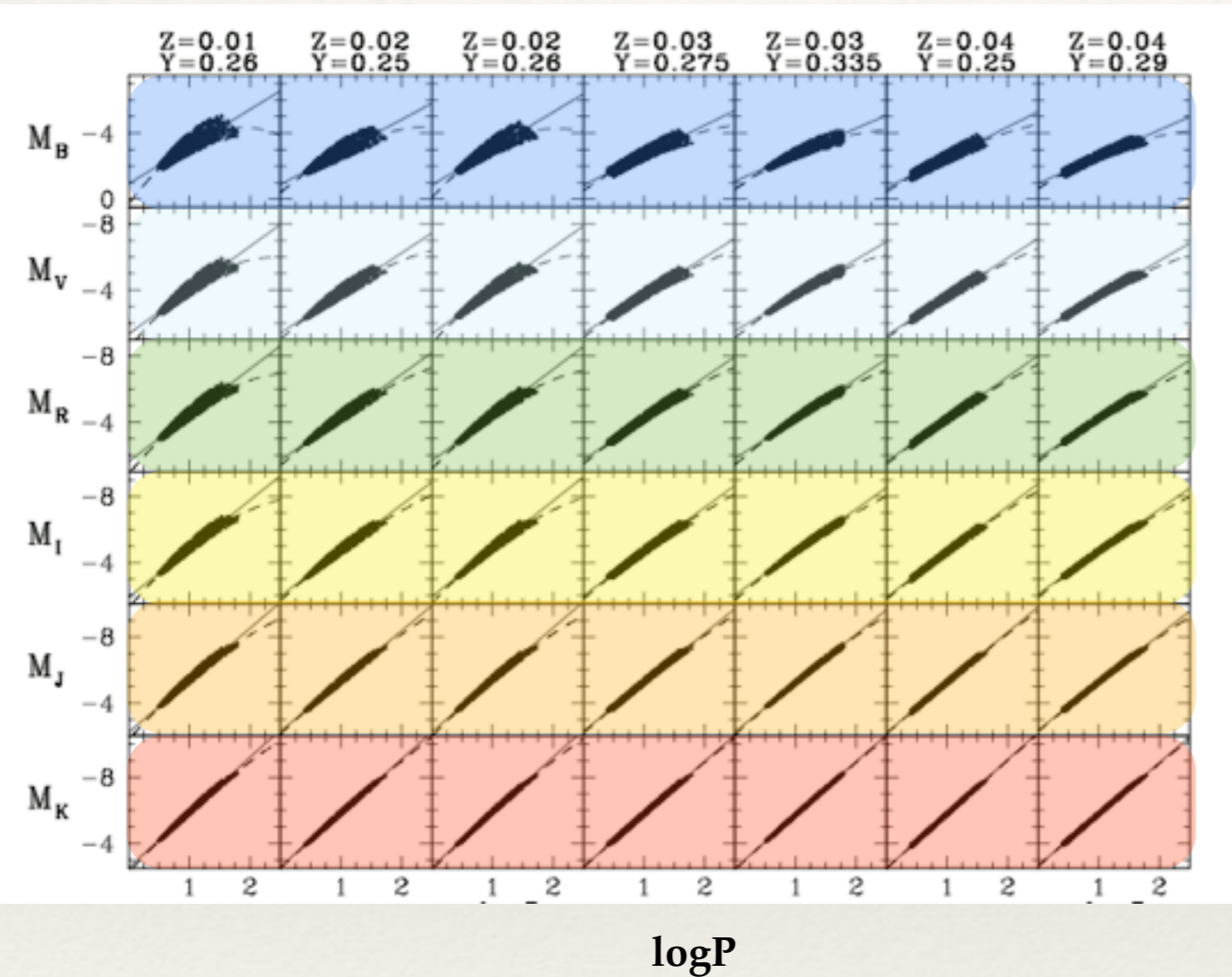
Complete scenario for Cepheids



- Bono, Marconi & Stellingwerf, 1999, ApJ, 122, 167
- Fiorentino, Marconi, Caputo, Musella, 2002, ApJ, 576, 402
- Marconi, Musella & Fiorentino, ApJ, 2005, 632, 590

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Complete scenario for Cepheids

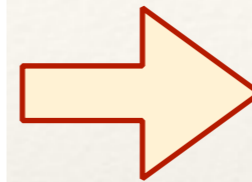
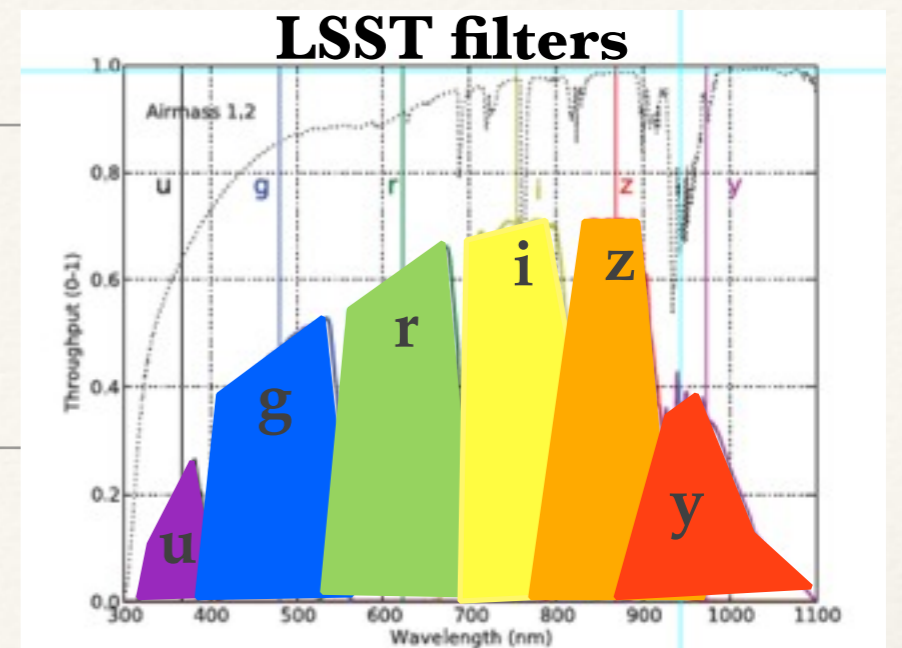
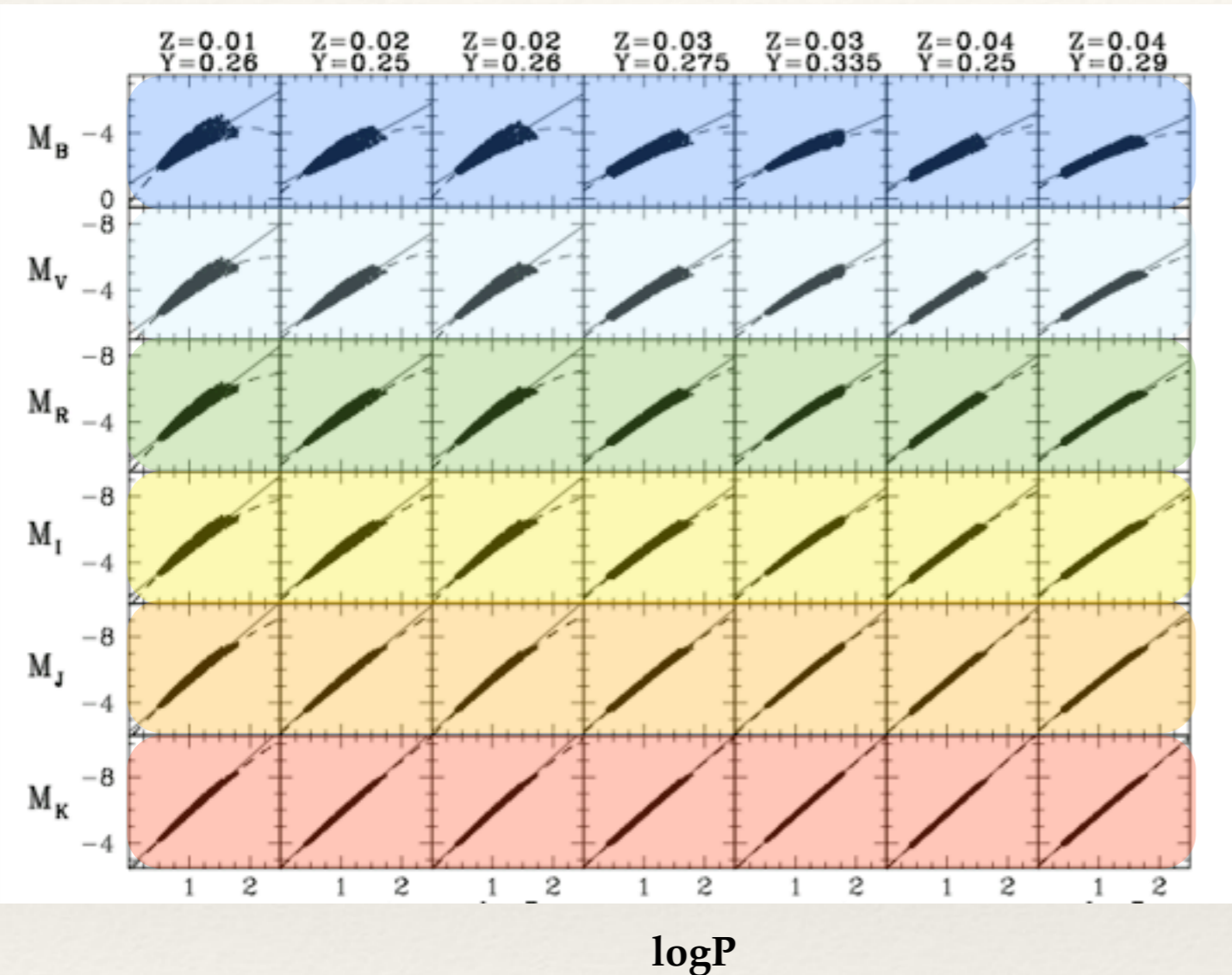


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Period-age relation

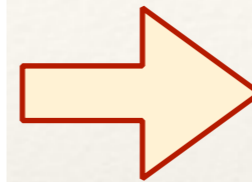
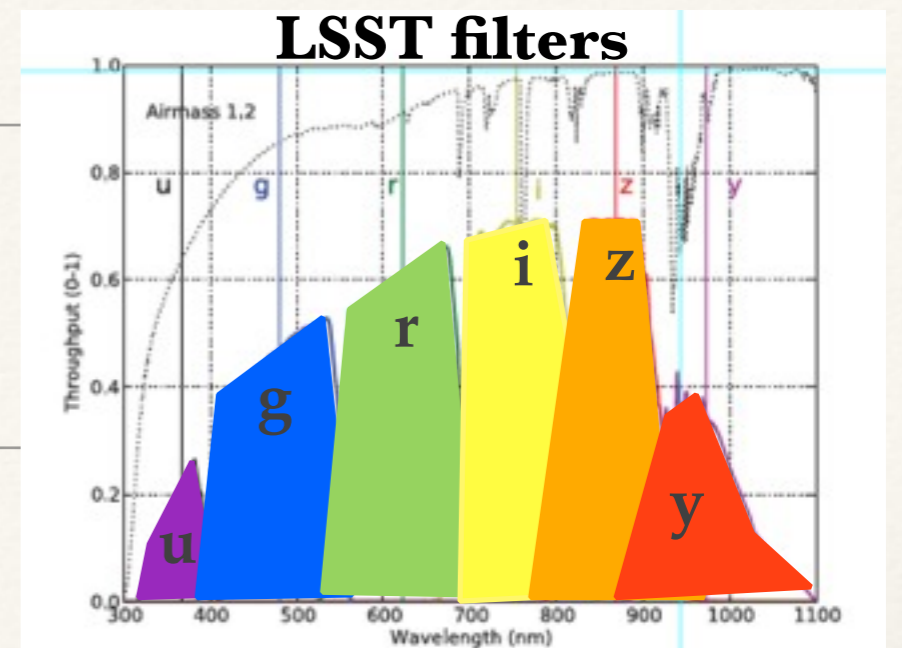
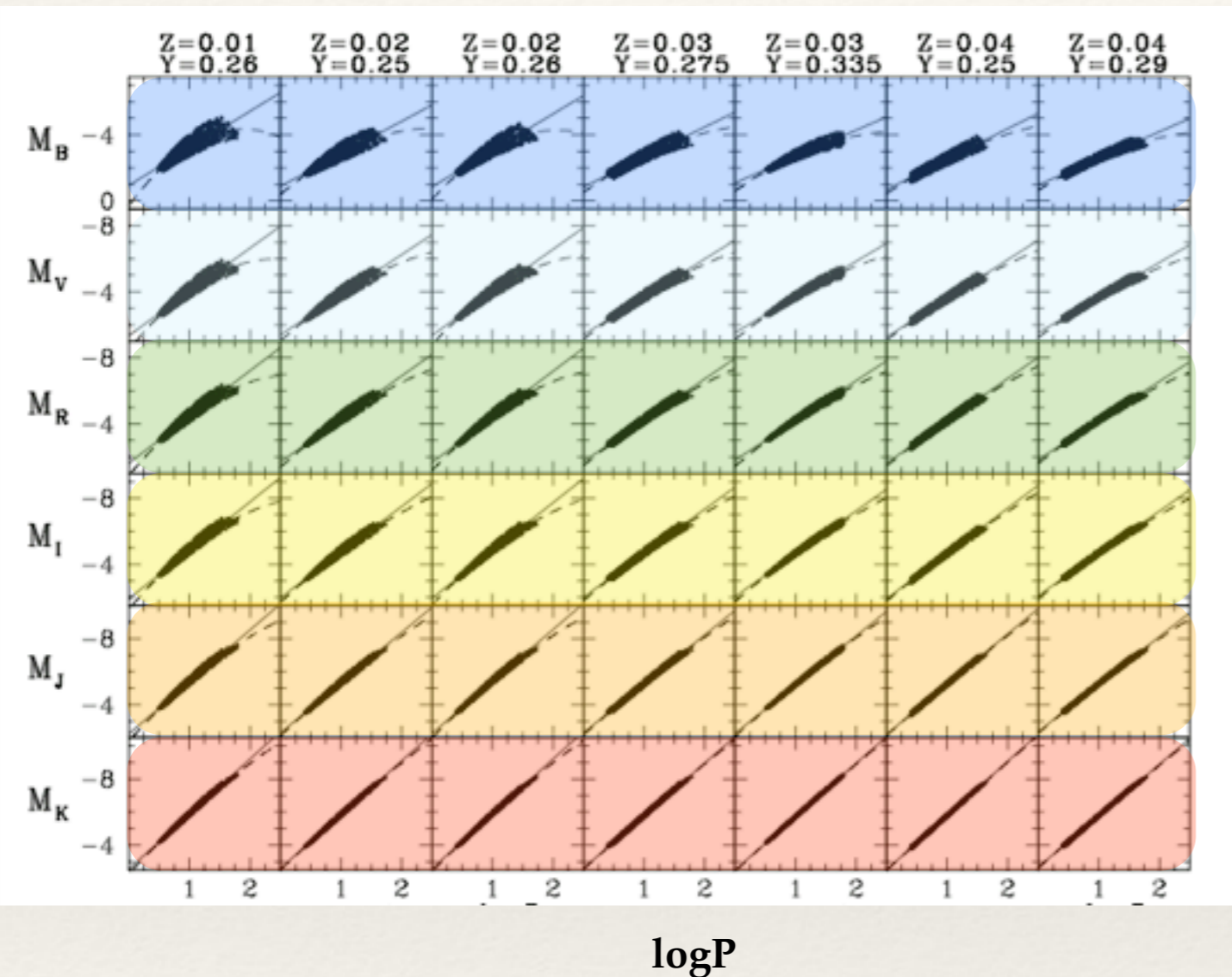


recent star formation

Bono, Marconi & Stellingwerf, 1999, ApJ, 122, 167
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Period-age relation



recent star formation

Rich et al. 2014 - method



REDDENING map

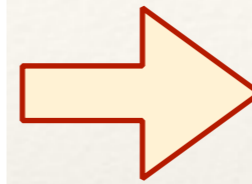
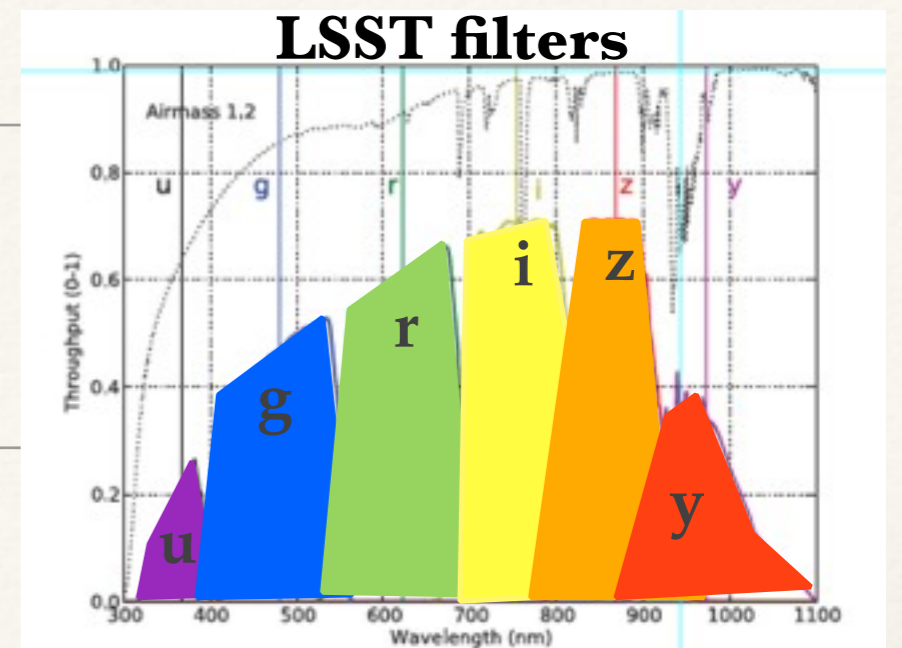
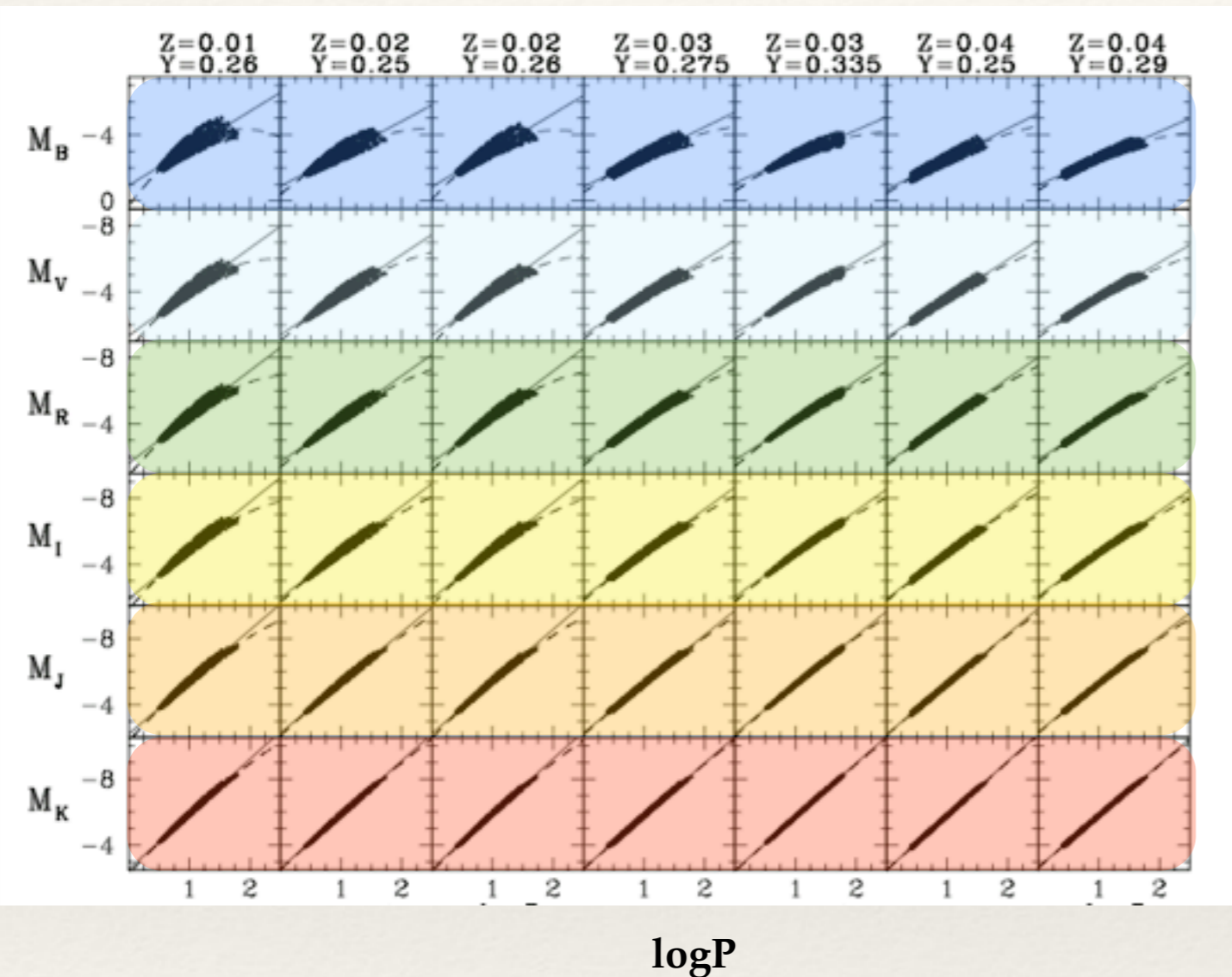
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REDDENING map

LSST wavelengths \rightarrow

Metallicity gradient

4

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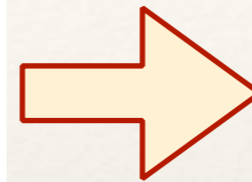
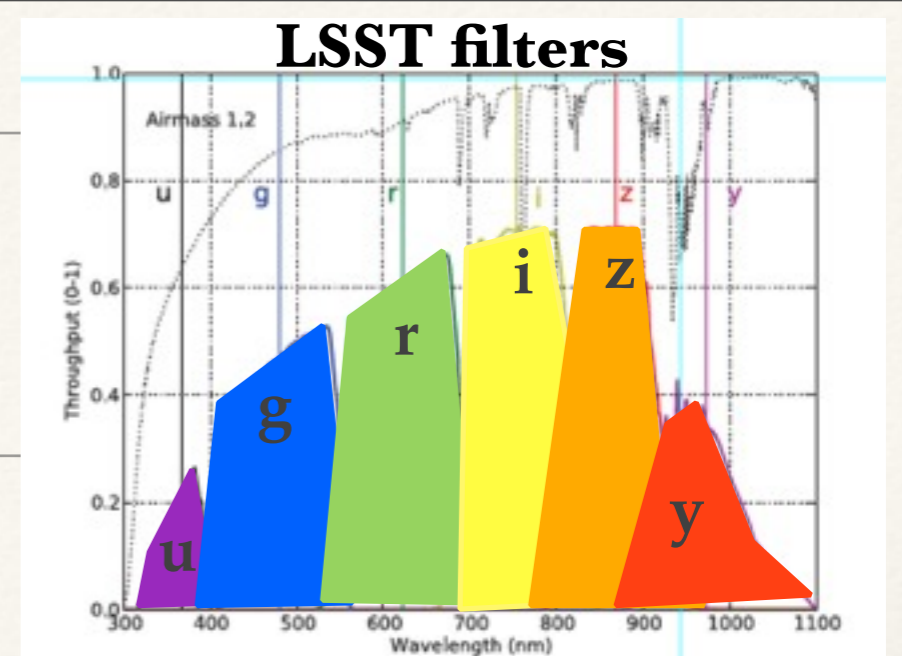
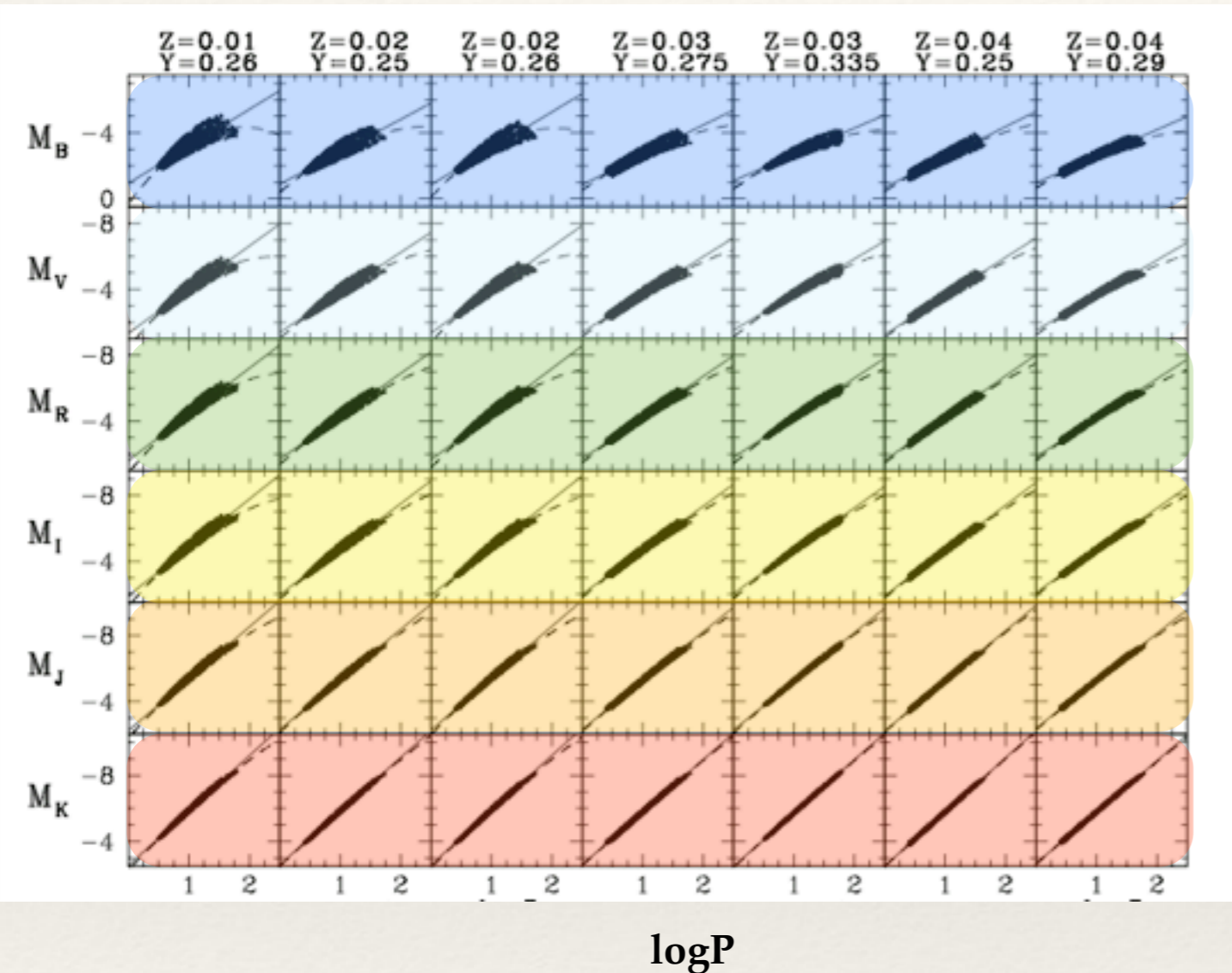
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Rome, July 14, 2016

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receding

method

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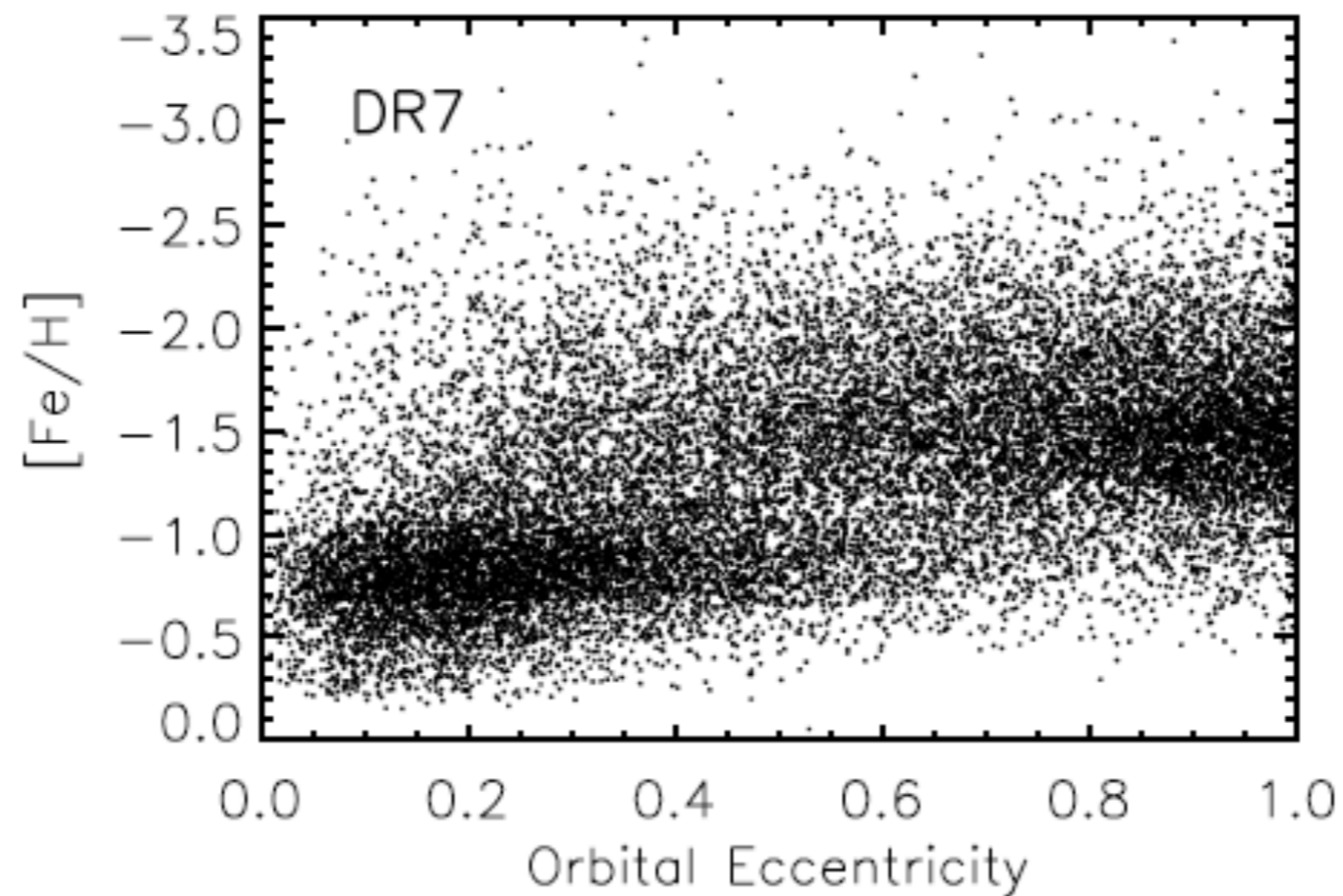
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Rome, July 14, 2016

Galactic dual halo components

kinematic analysis based on a sample of 16'000 stars from SDSS within 4Kpc

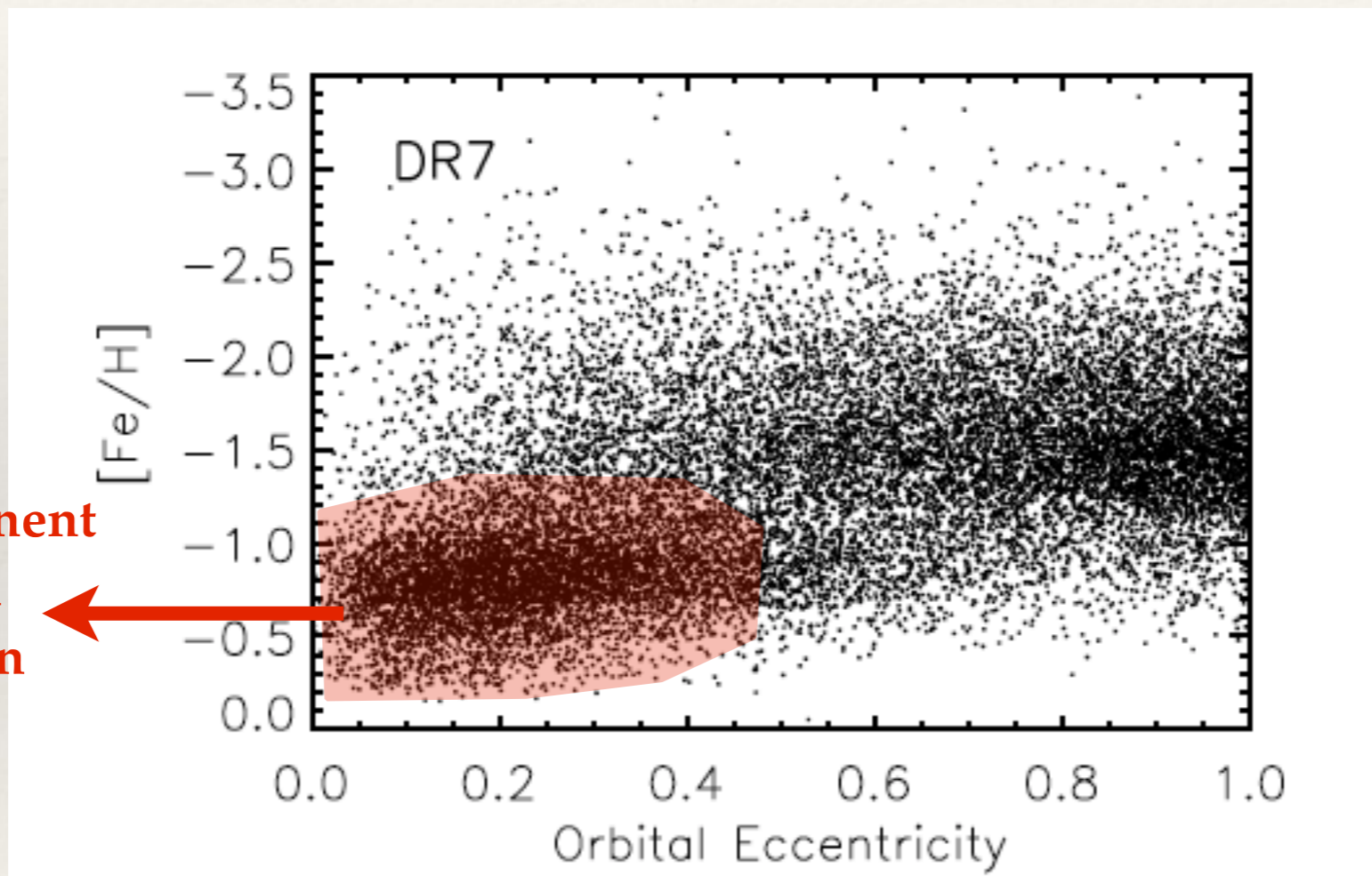


Carollo et al., 2007, Nature, 450, 1020

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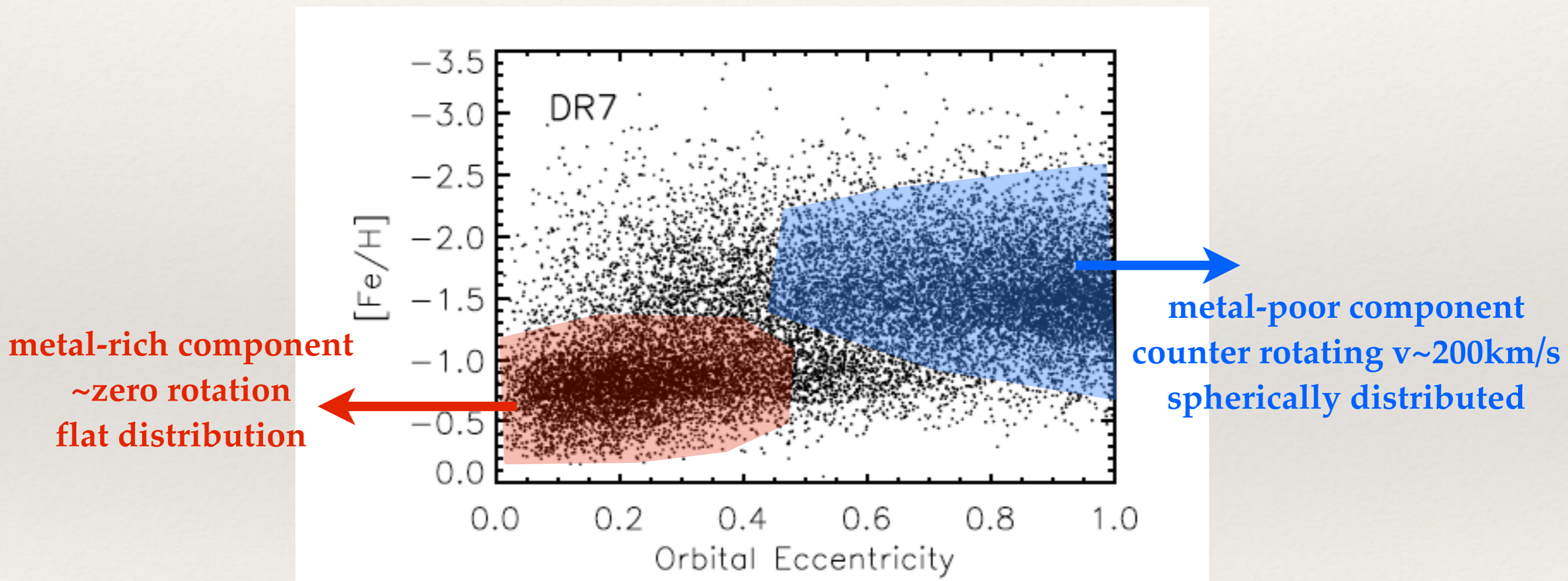
metal-rich component
~zero rotation
flat distribution



Carollo et al., 2007, Nature, 450, 1020

Galactic dual halo components

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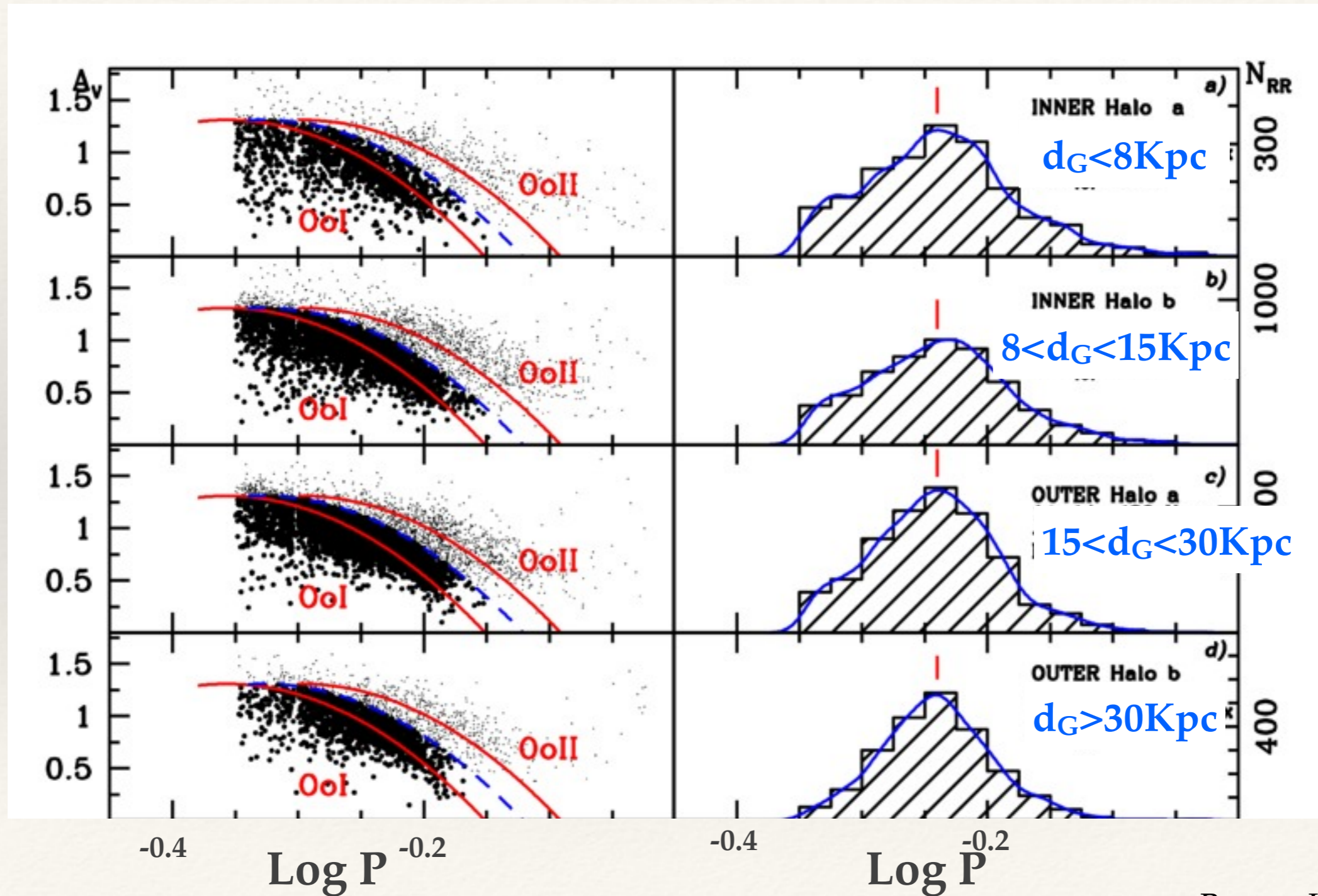


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Inner-Outer Halo transition

Mainly Catalina survey (Drake et al. 2013), **one-wavelength analysis (V)**

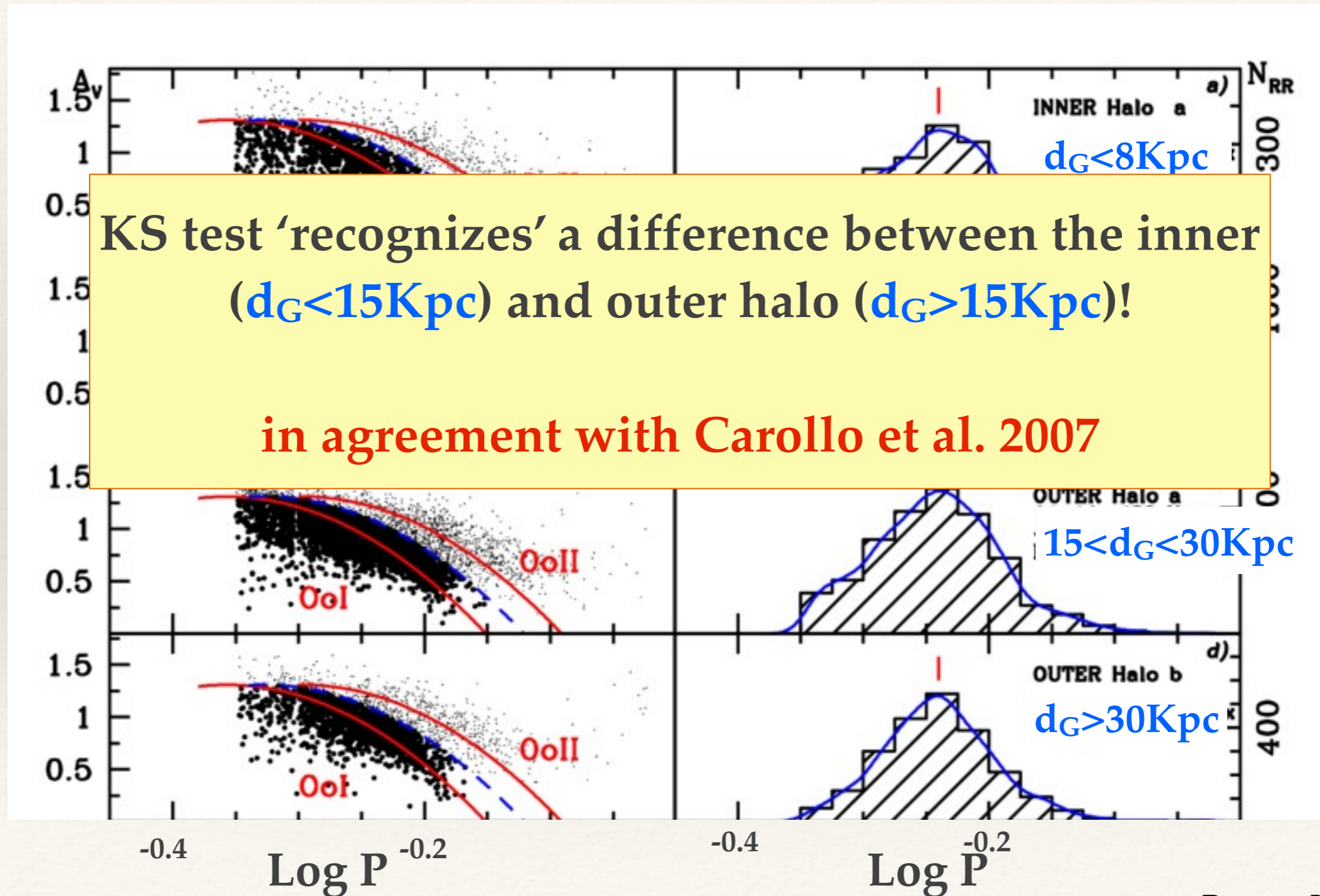
Stetson et al. 2014, PASP, 616, 216



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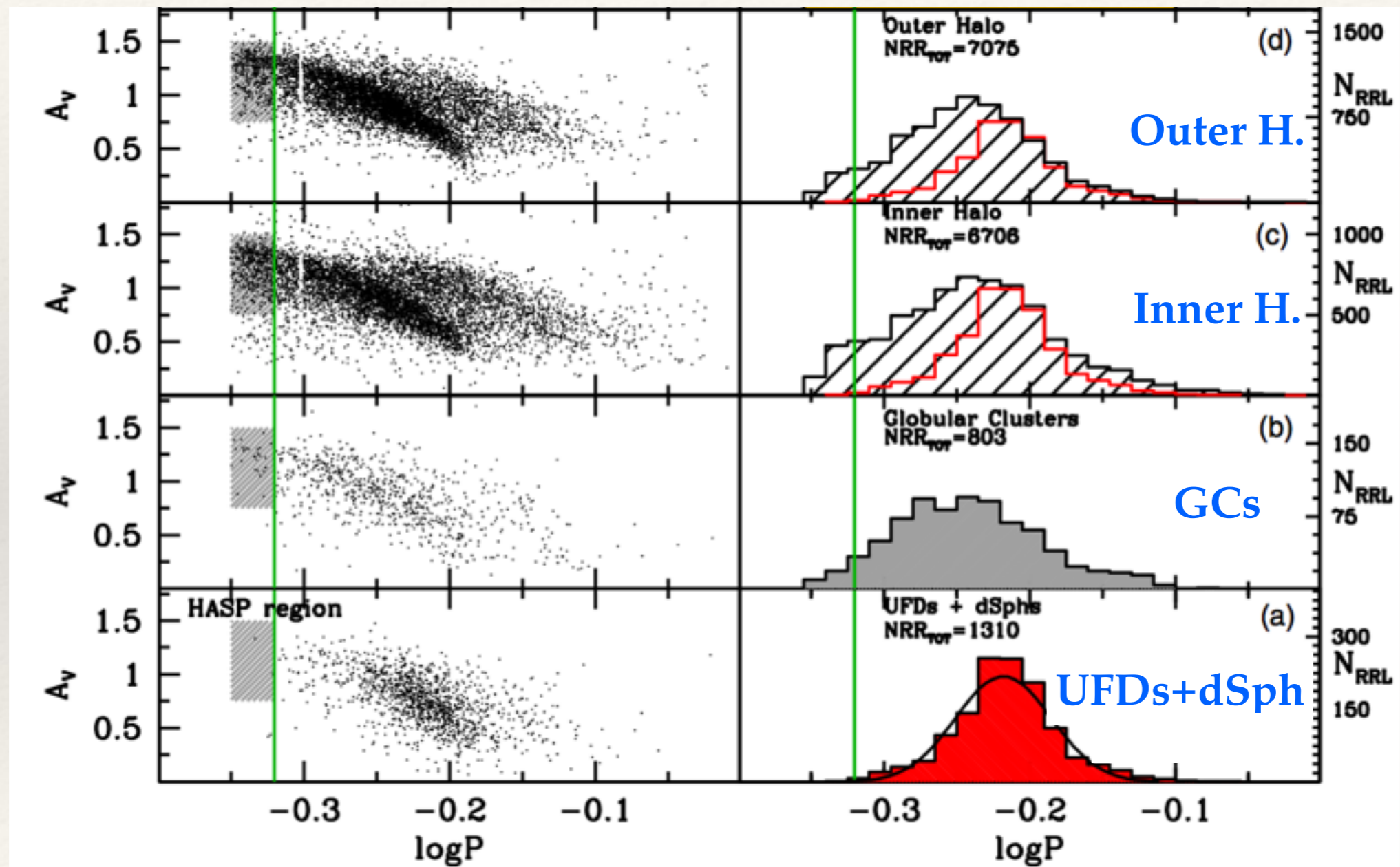
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Galaxy formation

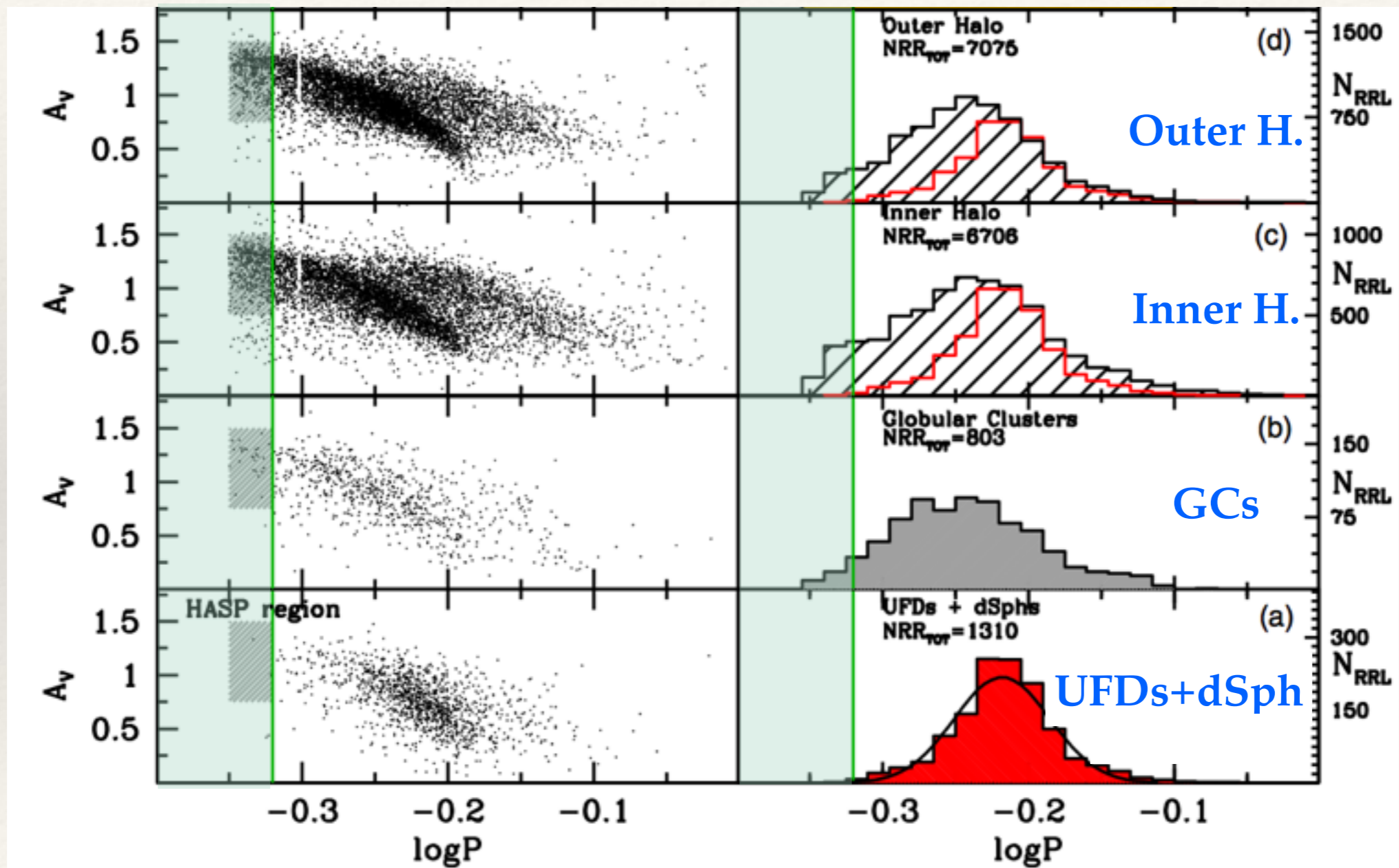
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Galaxy formation

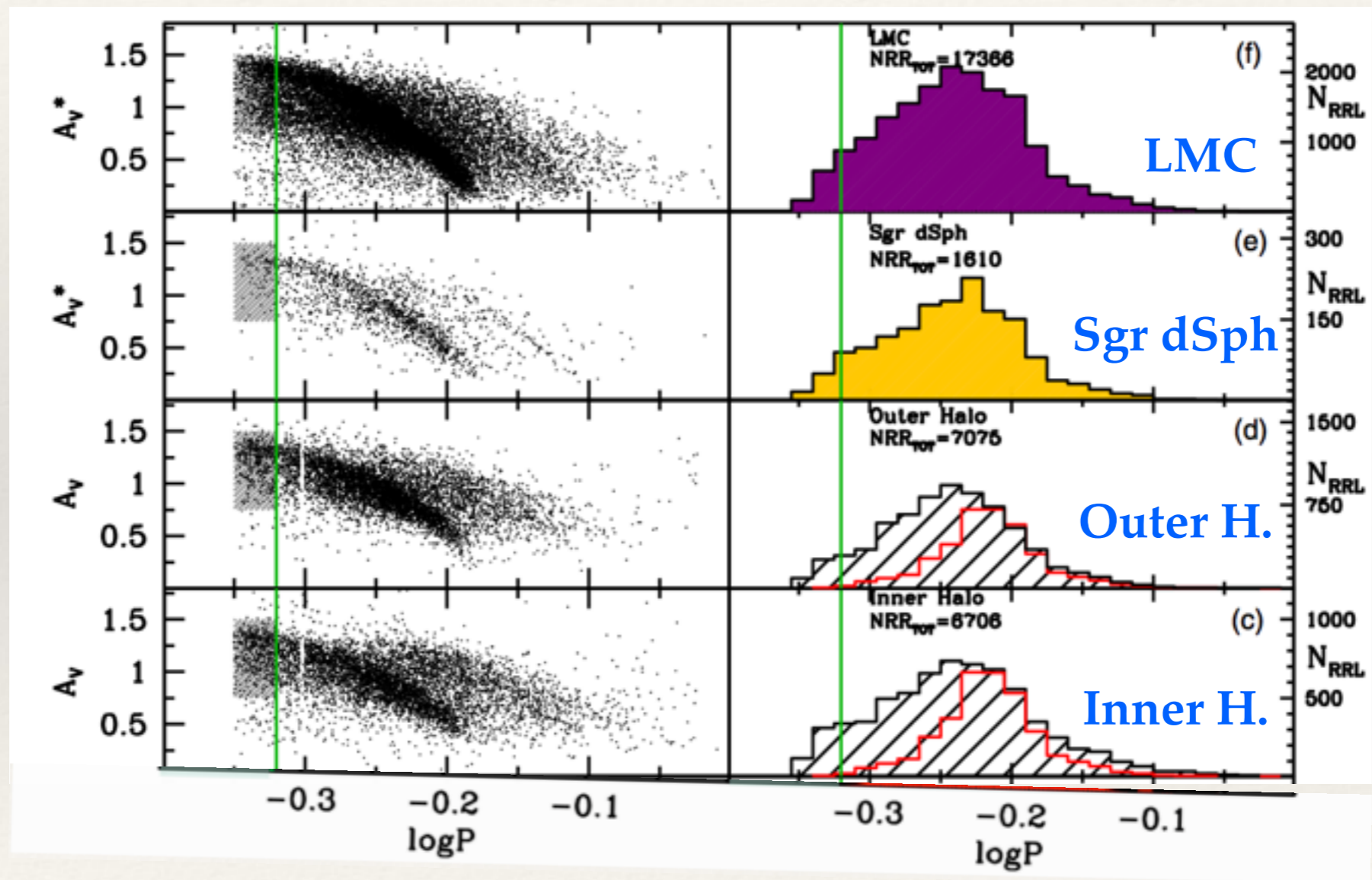
High Amplitude Short Period (HASP) RRab are missing in classical dwarfs!!

Fiorentino et al. 2015, ApJL, 798L, 12



Galaxy formation

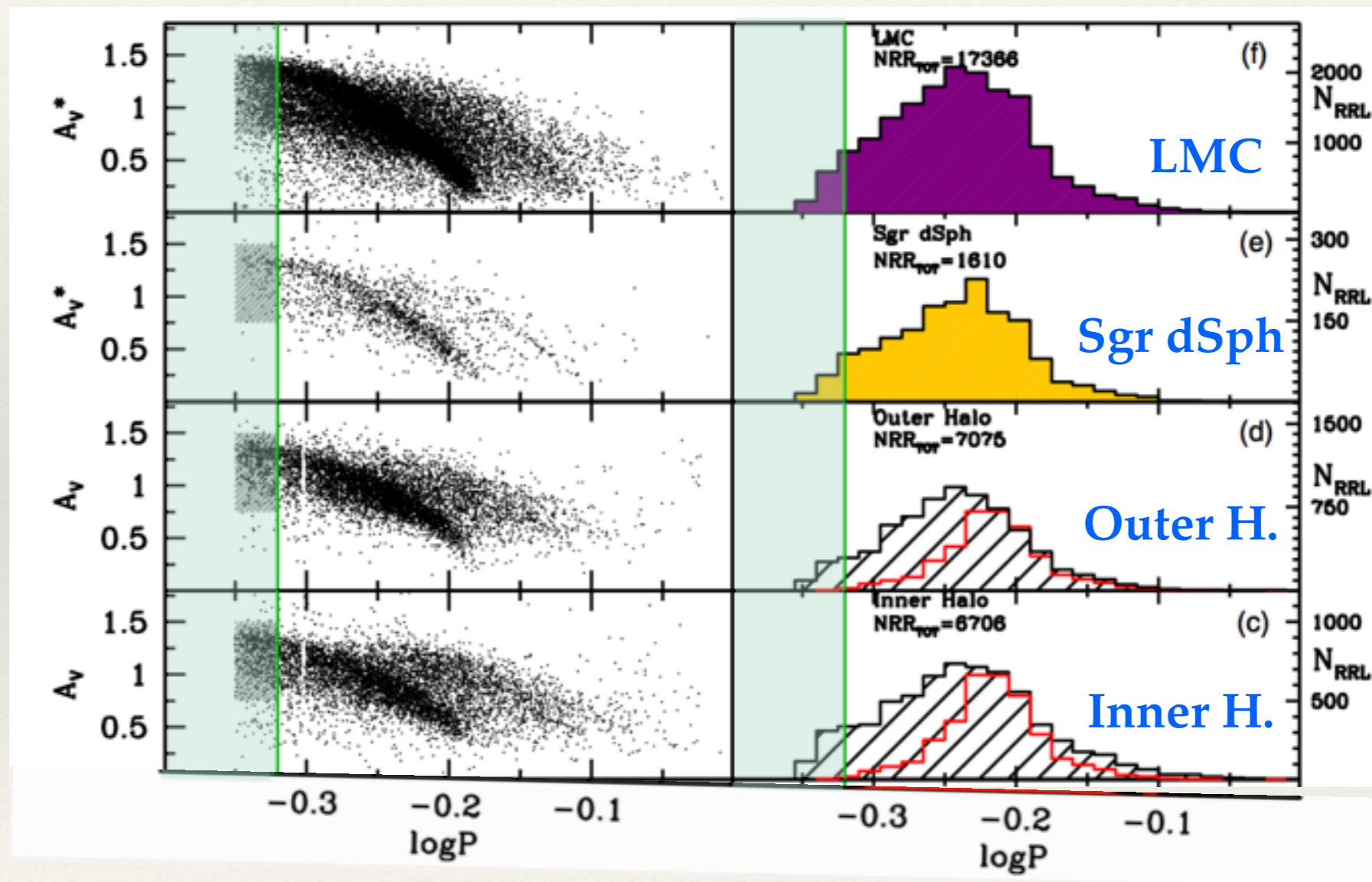
Fiorentino et al. 2015, ApJL, 798L, 12



Galaxy formation

High Amplitude Short Period (HASP) RRab are observed in large dwarfs!!

Fiorentino et al. 2015, ApJL, 798L, 12

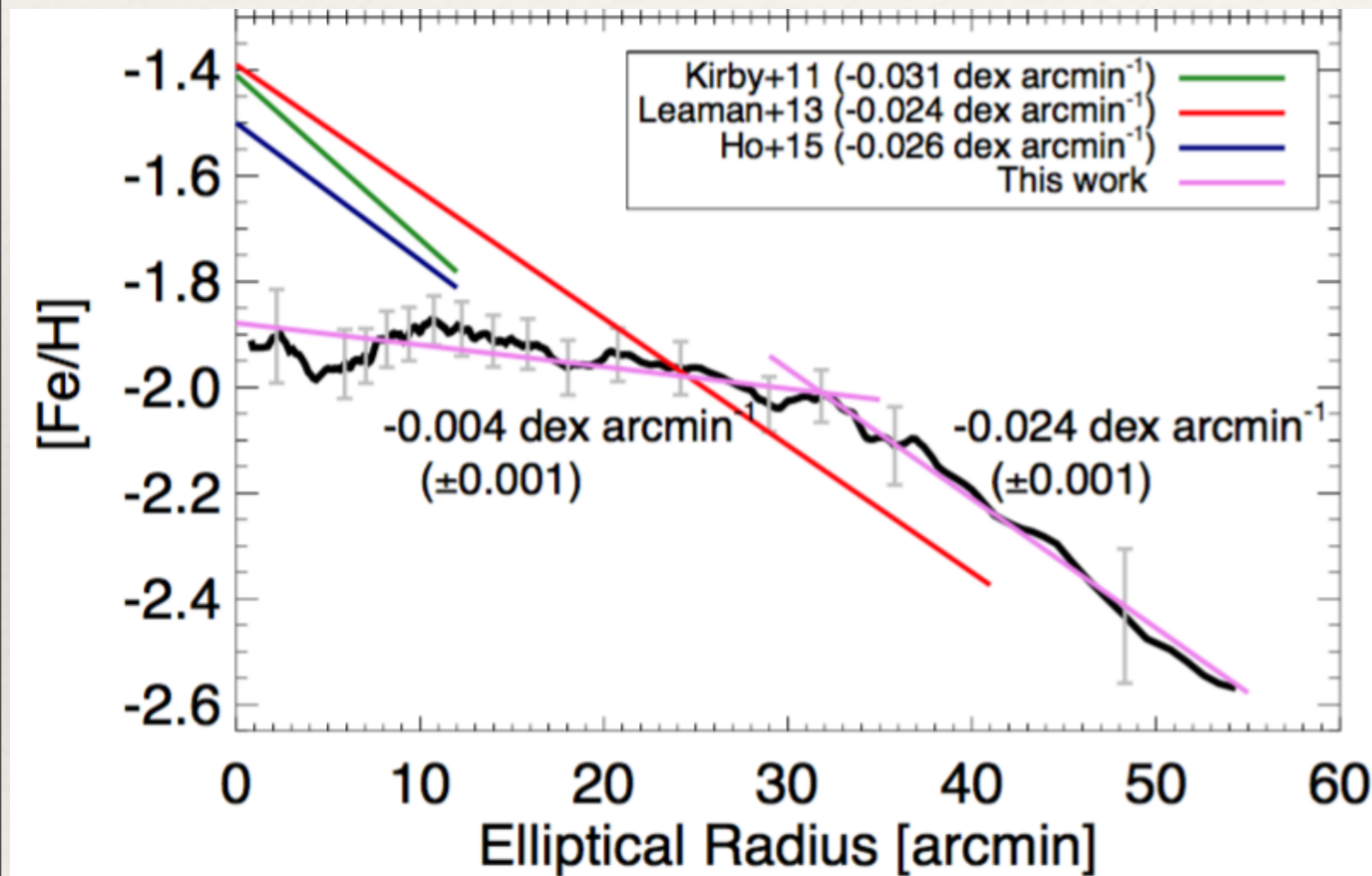


dwarf galaxies in the Local group

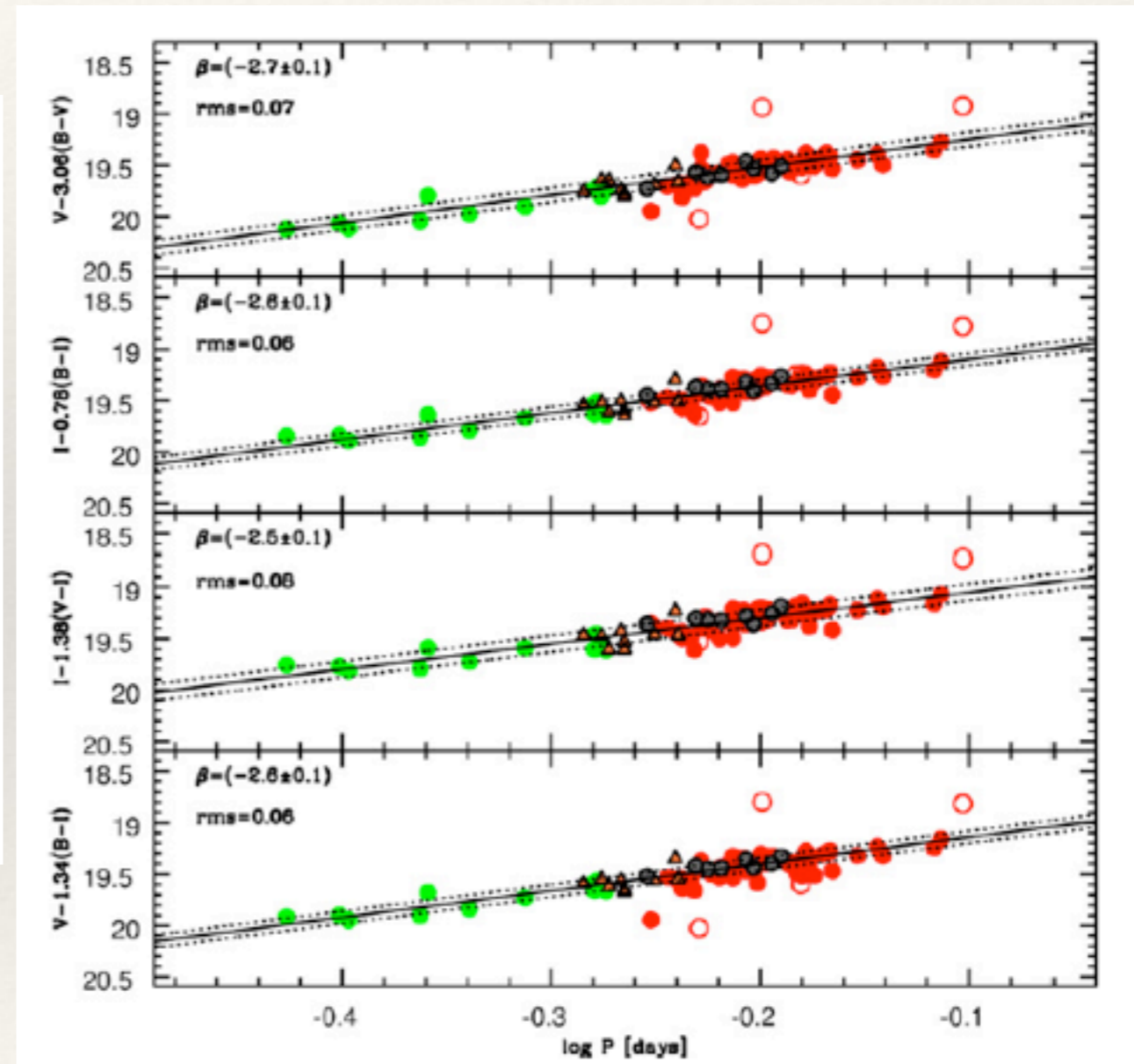
archival and proprietary data, multi-wavelength analyses (BVI)

Sculptor dwarf galaxy
metallicity gradient

Carina dwarf galaxy
distance



Martinez-Vazsquez et al. 2016, MNRAS, 461, 41



Coppola et al. 2015, ApJ, 814, 71 ⁹

Rome, July 14, 2016

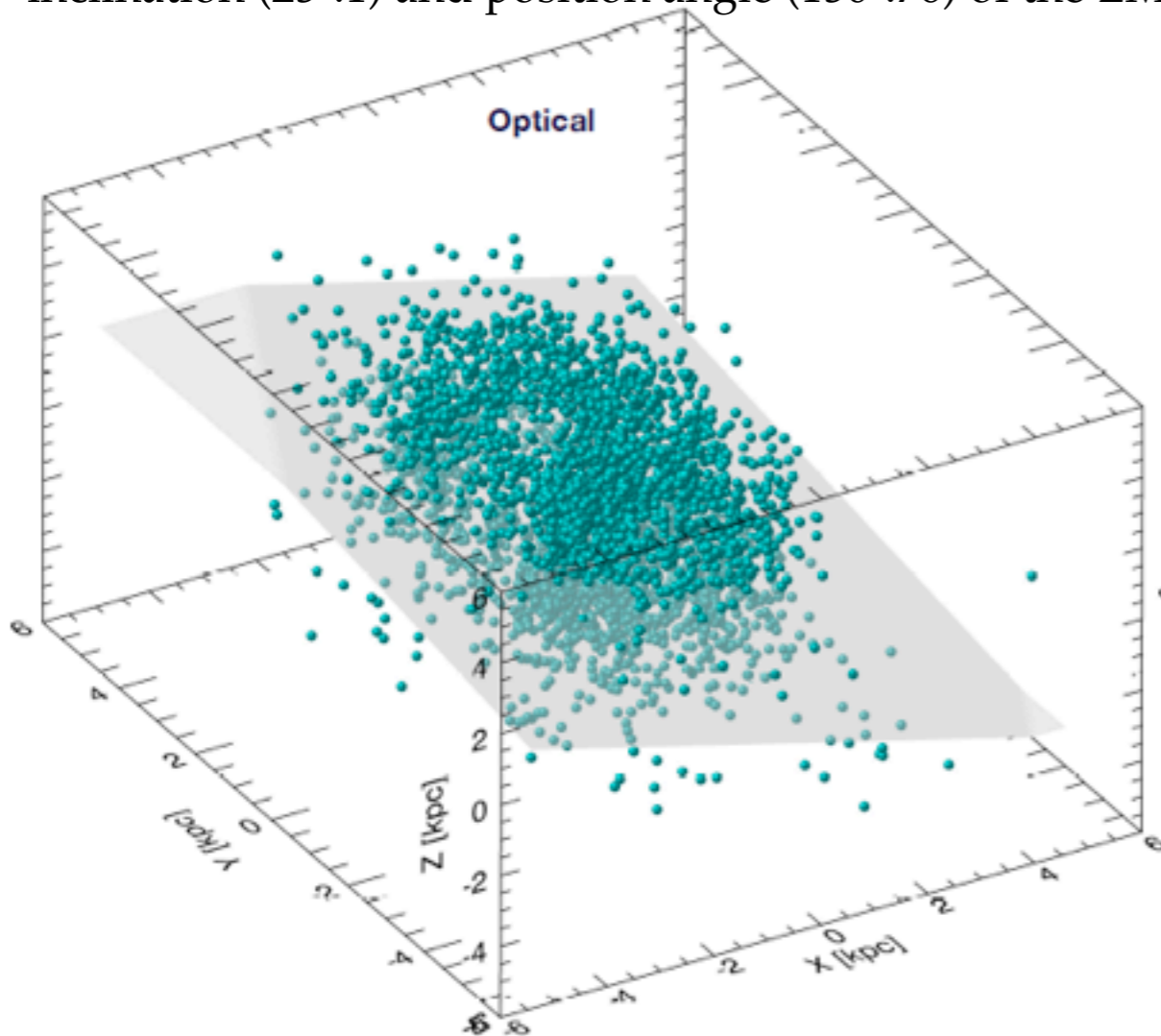
dwarf galaxies in the Local group

archival and proprietary data, multi-wavelength analyses (VIJHK[3.4] μm)

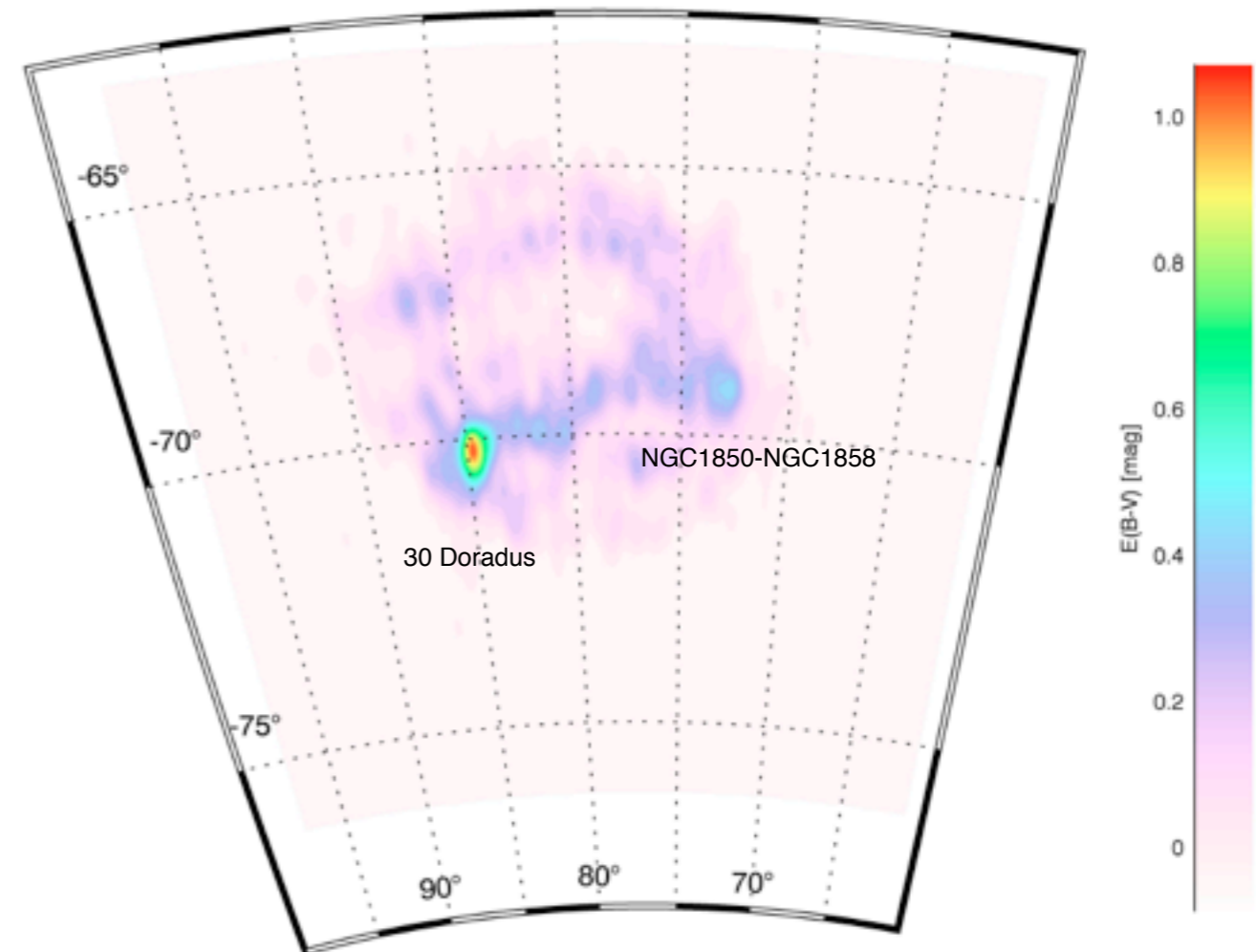
Large Magellanic Cloud

3D-structure


inclination ($25^\circ.1$) and position angle ($150^\circ.76$) of the LMC disk



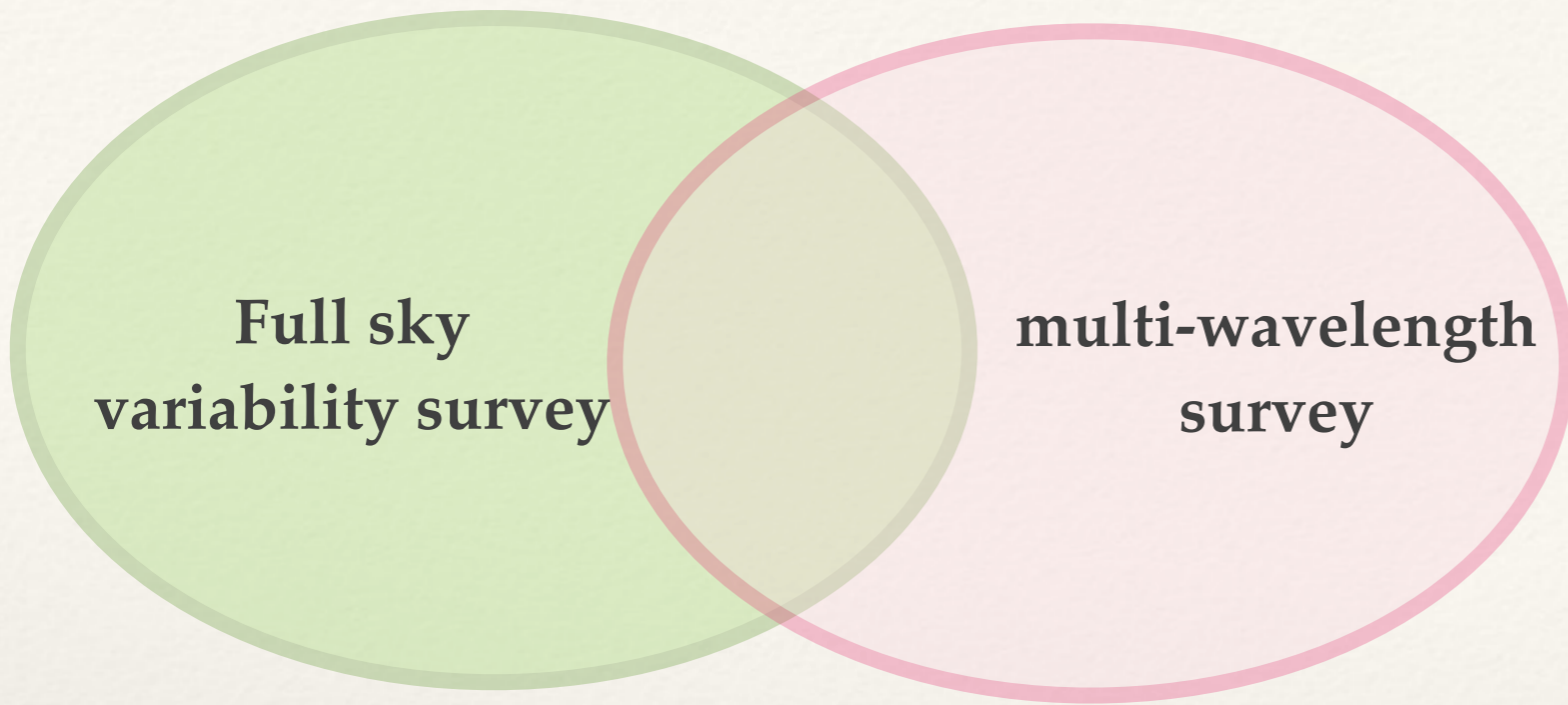
Reddening map



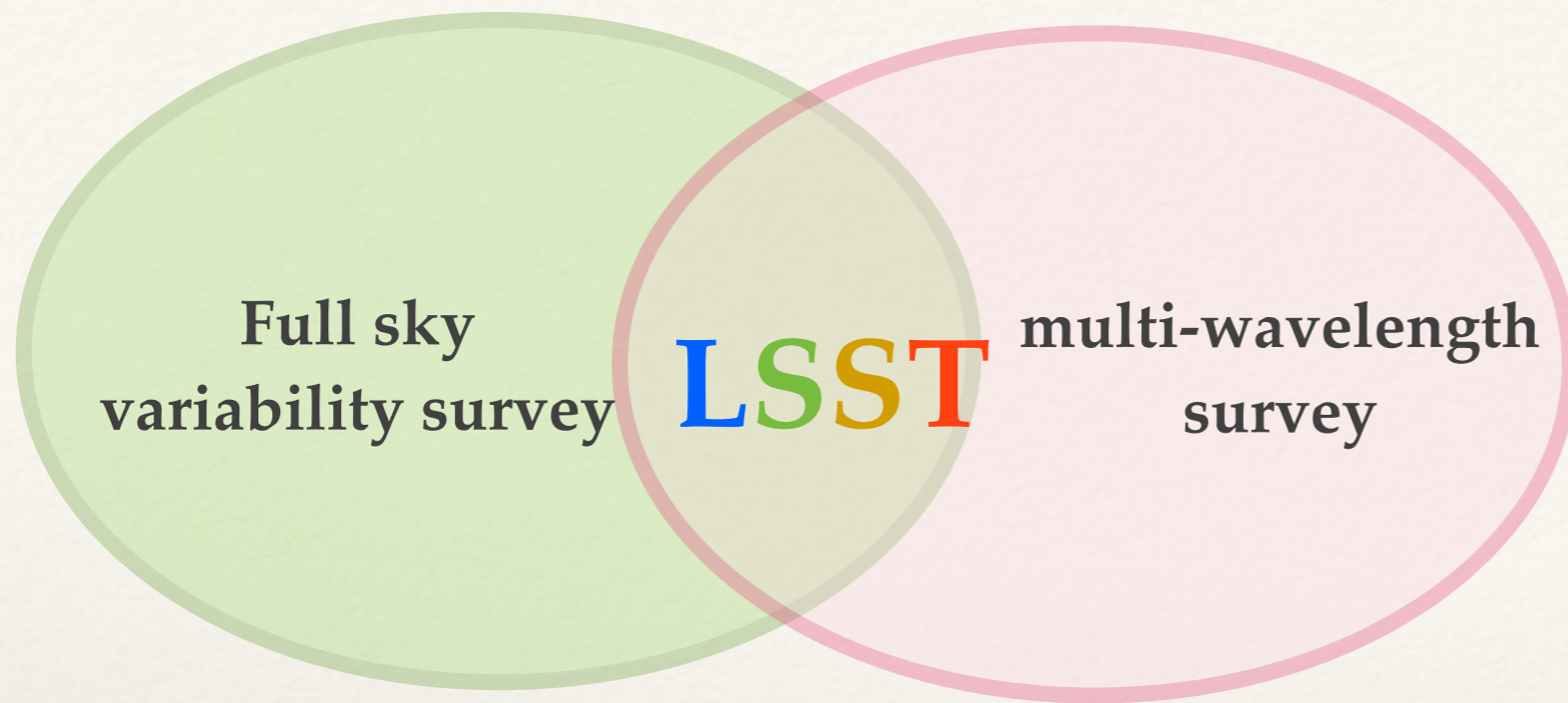
Inno et al., submitted



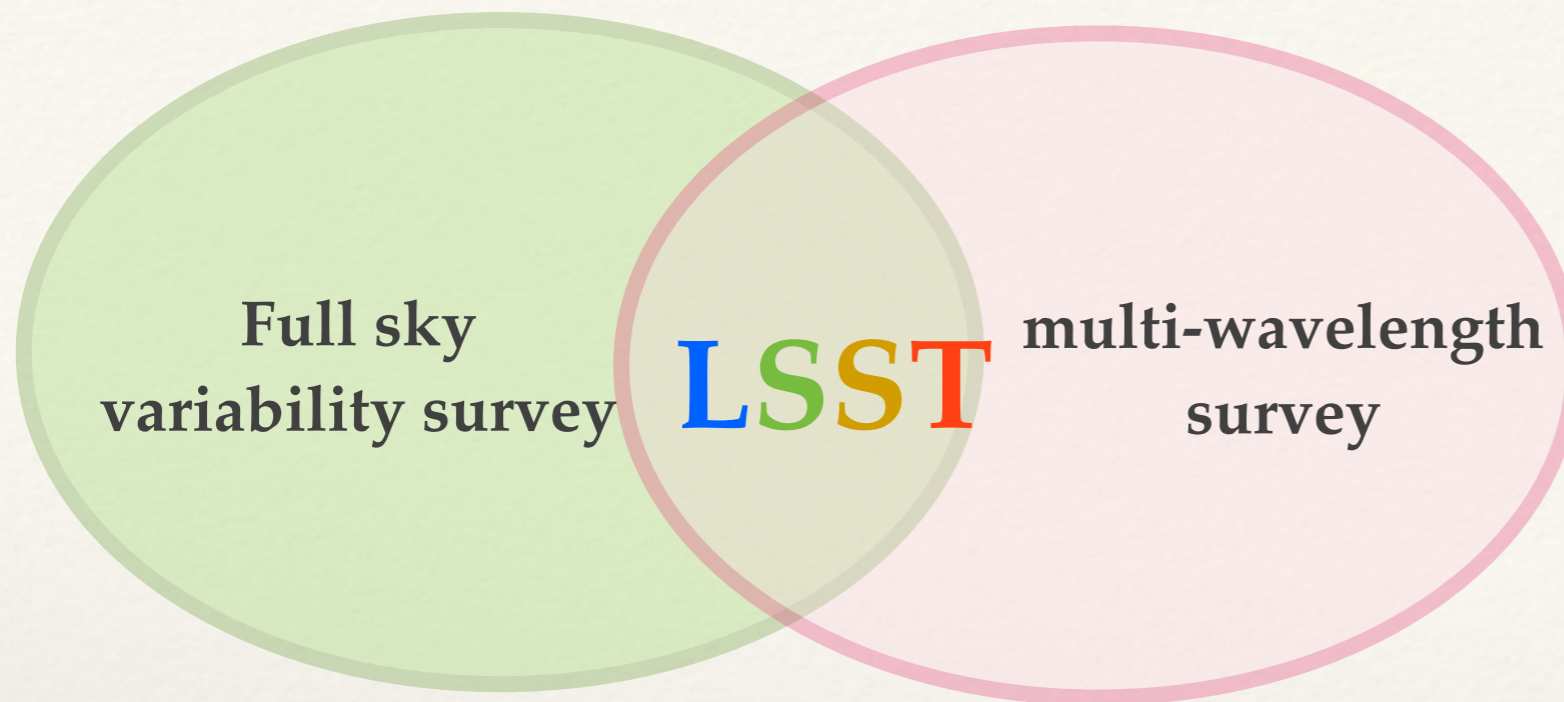
**Full sky
variability survey**



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- full characterization of all the variables (from few hours to 100 days)
 - detailed characterization of the Milky Way structure (bulge/disk/halo)
 - Galaxy formation: homogeneous comparison GCs/dwarfs/Milky Way
-



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...a lot to learn from elders and from youngsters!

Why do we want an LSST International Affiliation?

- characterization of time-series for variable stars, not provided in data releases
- interaction with LSST Working groups to define the best data products
- individual epochs for light curves → essential for any spectroscopic follow-up