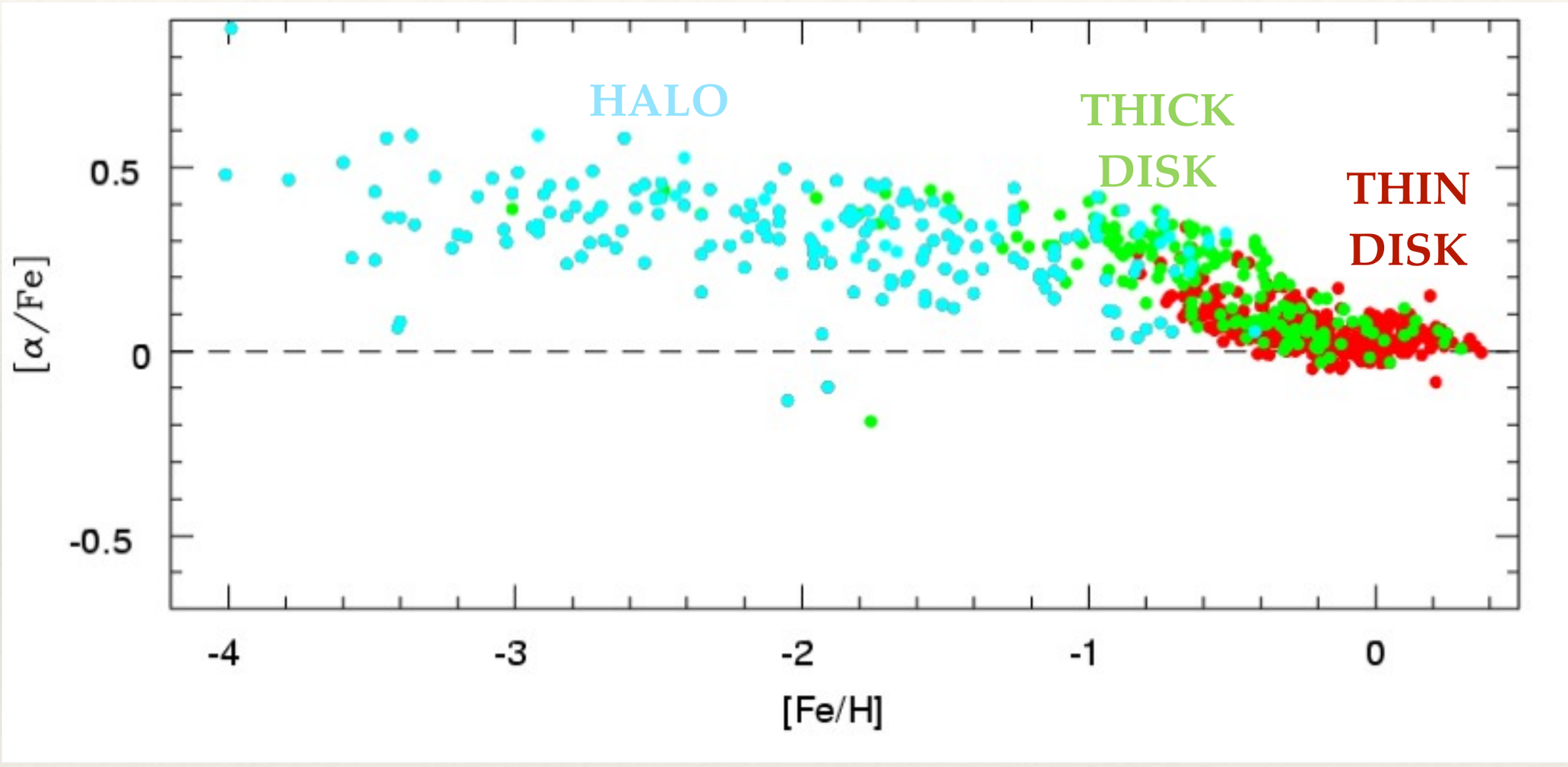
RR Lyrae stars: building-up the Galactic halo with dwarf spheroidals

G. Fiorentino INAF-Osservatorio Astronomico di Bologna

RASPUTIN, ESO, 13 October

Galactic Archaeology to constrain our Galaxy formation



see K. Venn talk

compilation by Venn et al. 2004

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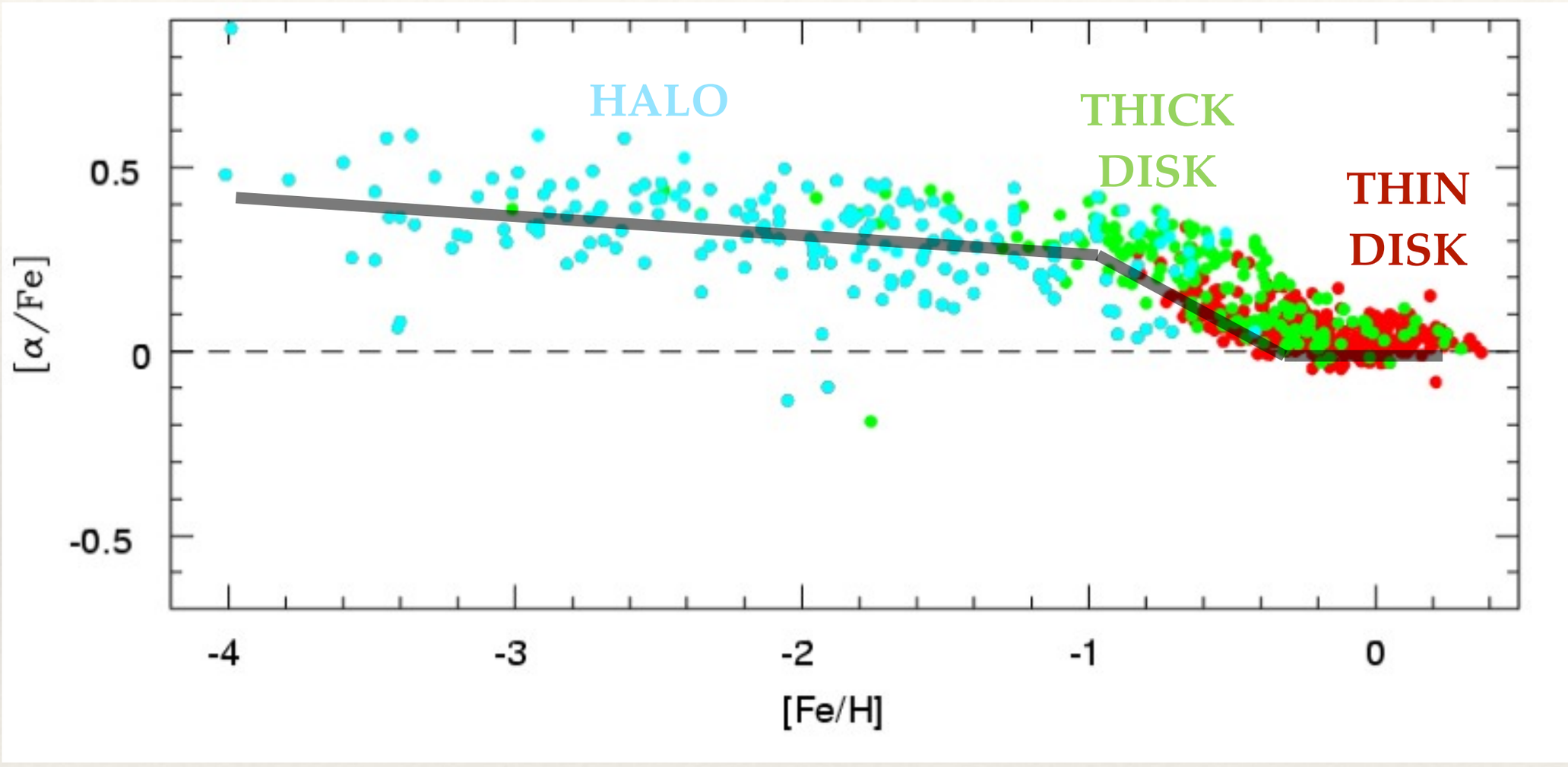

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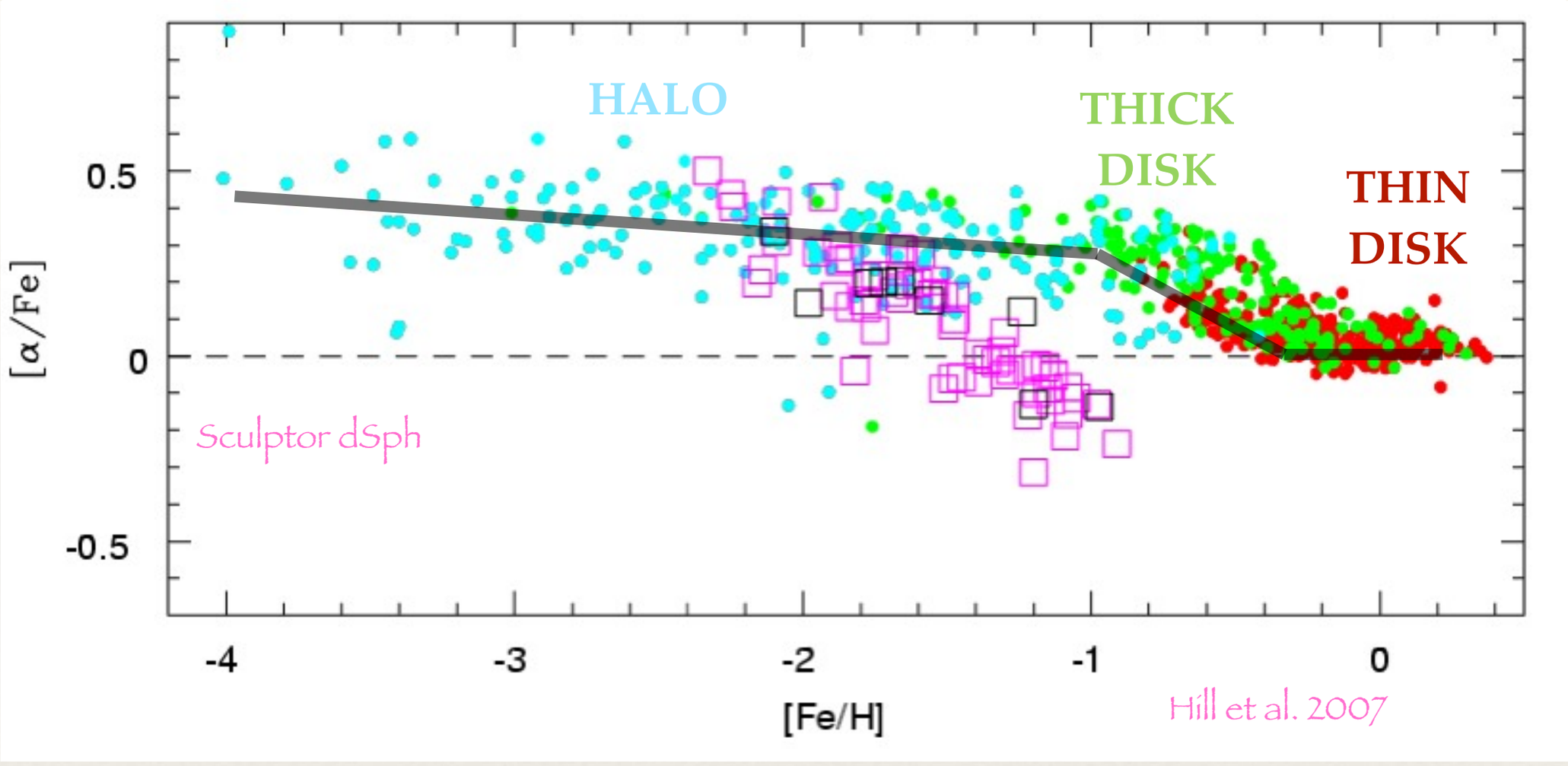

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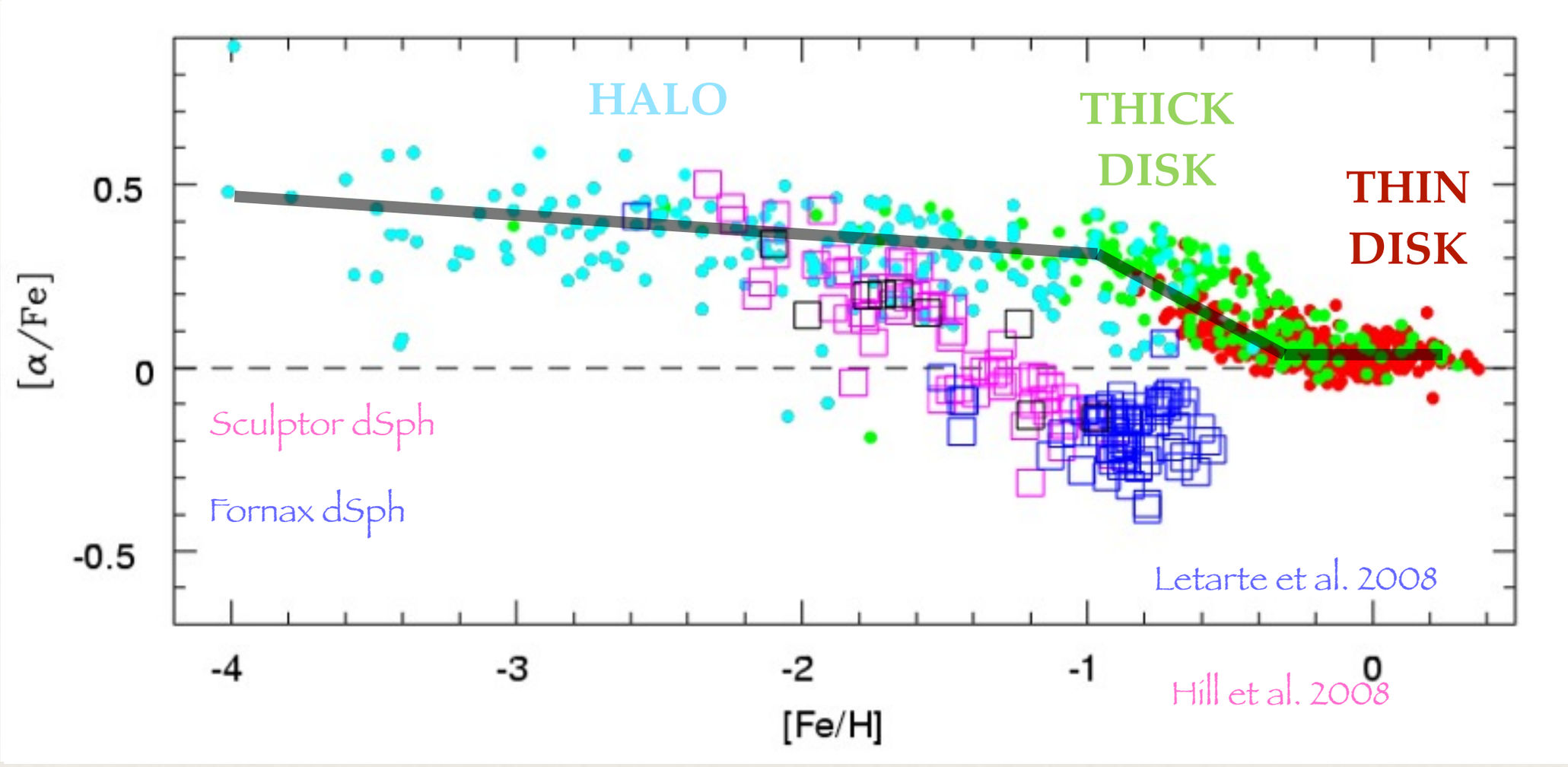

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Why RR Lyrae stars are so interesting for Galaxy formation?

- old stellar population tracers
  (HB stars, age > 10Gyr)

- they are distance indicators, they can trace different components in the Galaxy

- they are almost in everywhere. Galactic halo/bulge/thick disk, globular clusters, classical and ultra faint dwarfs

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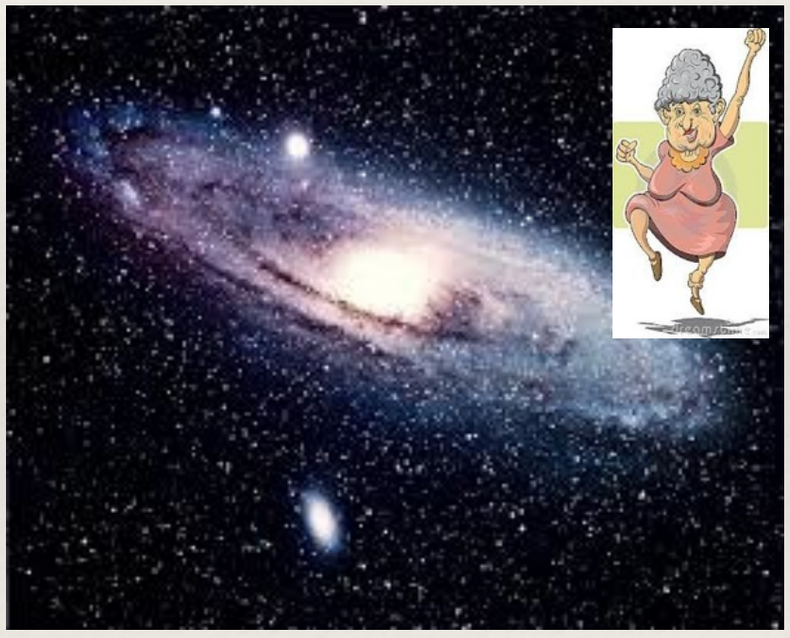

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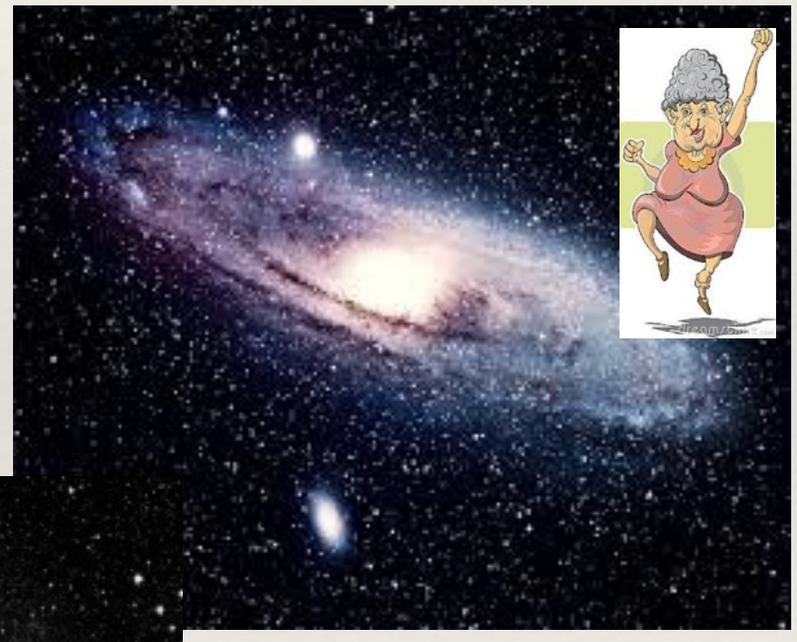

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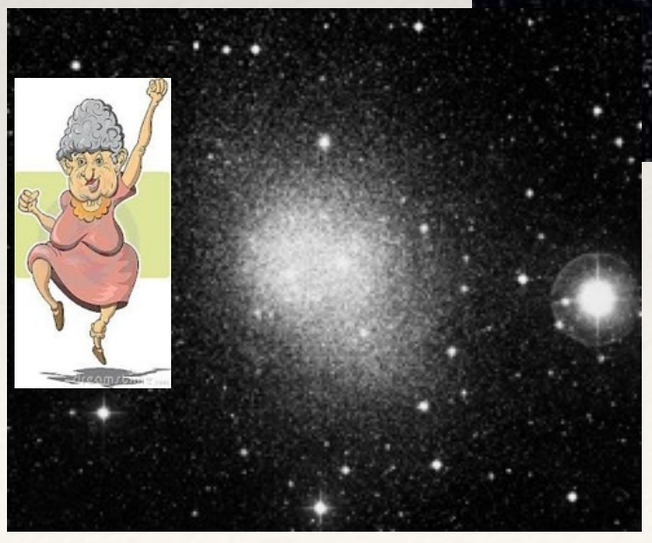

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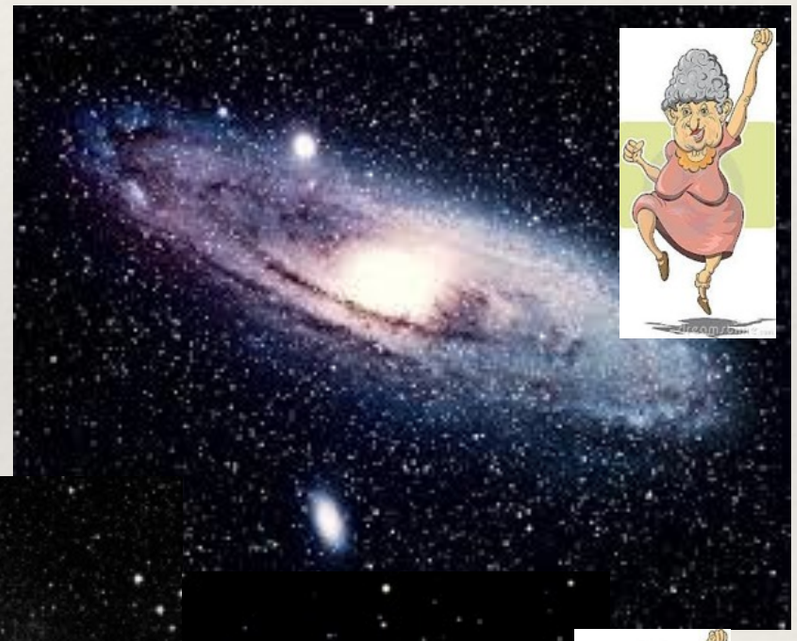

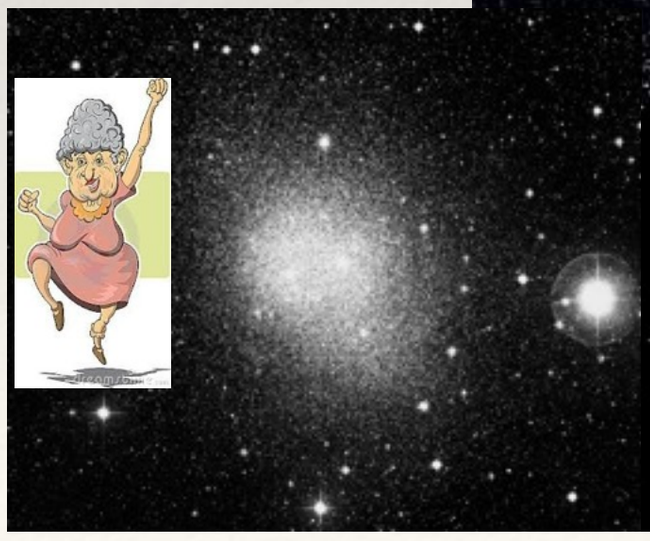

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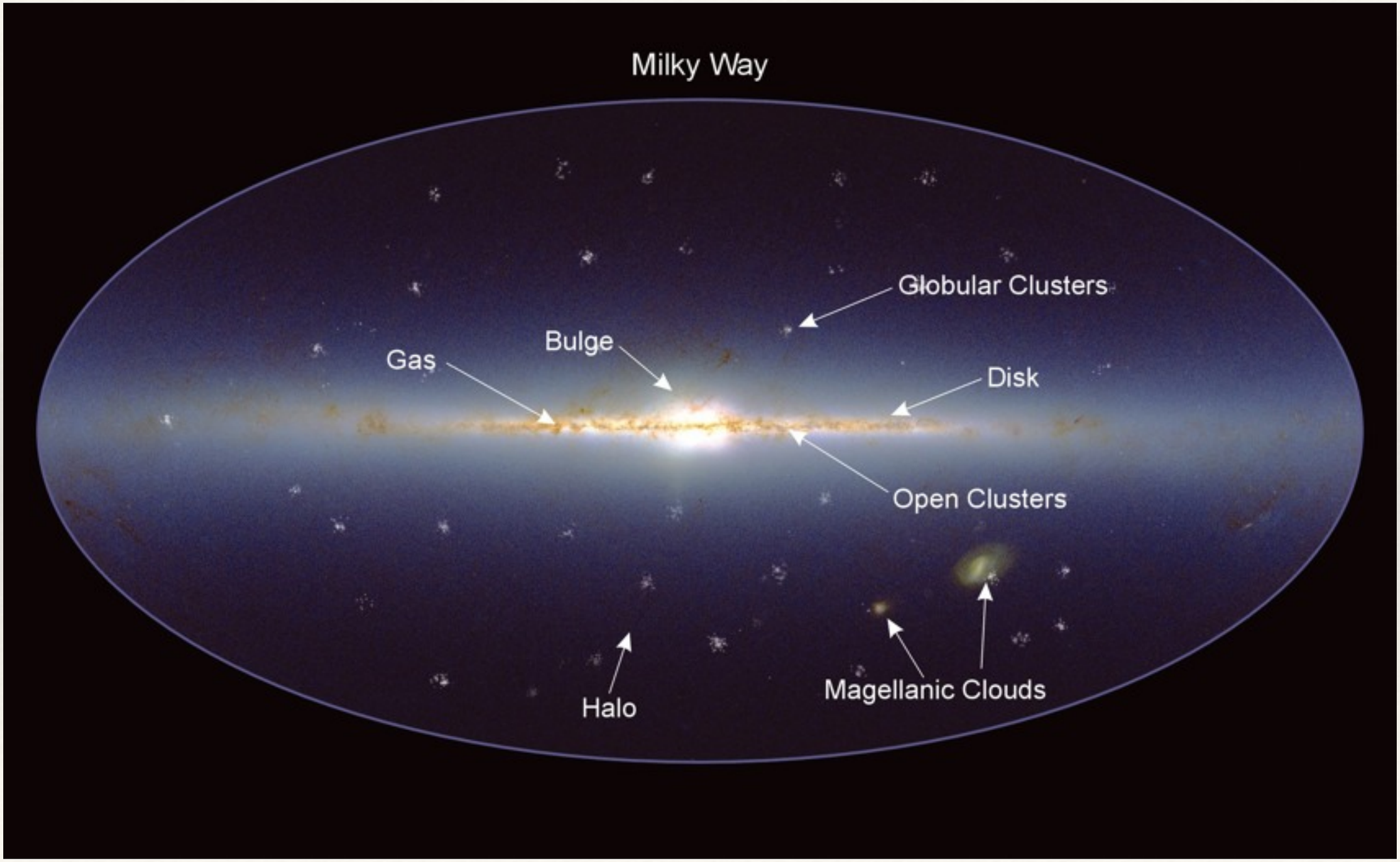

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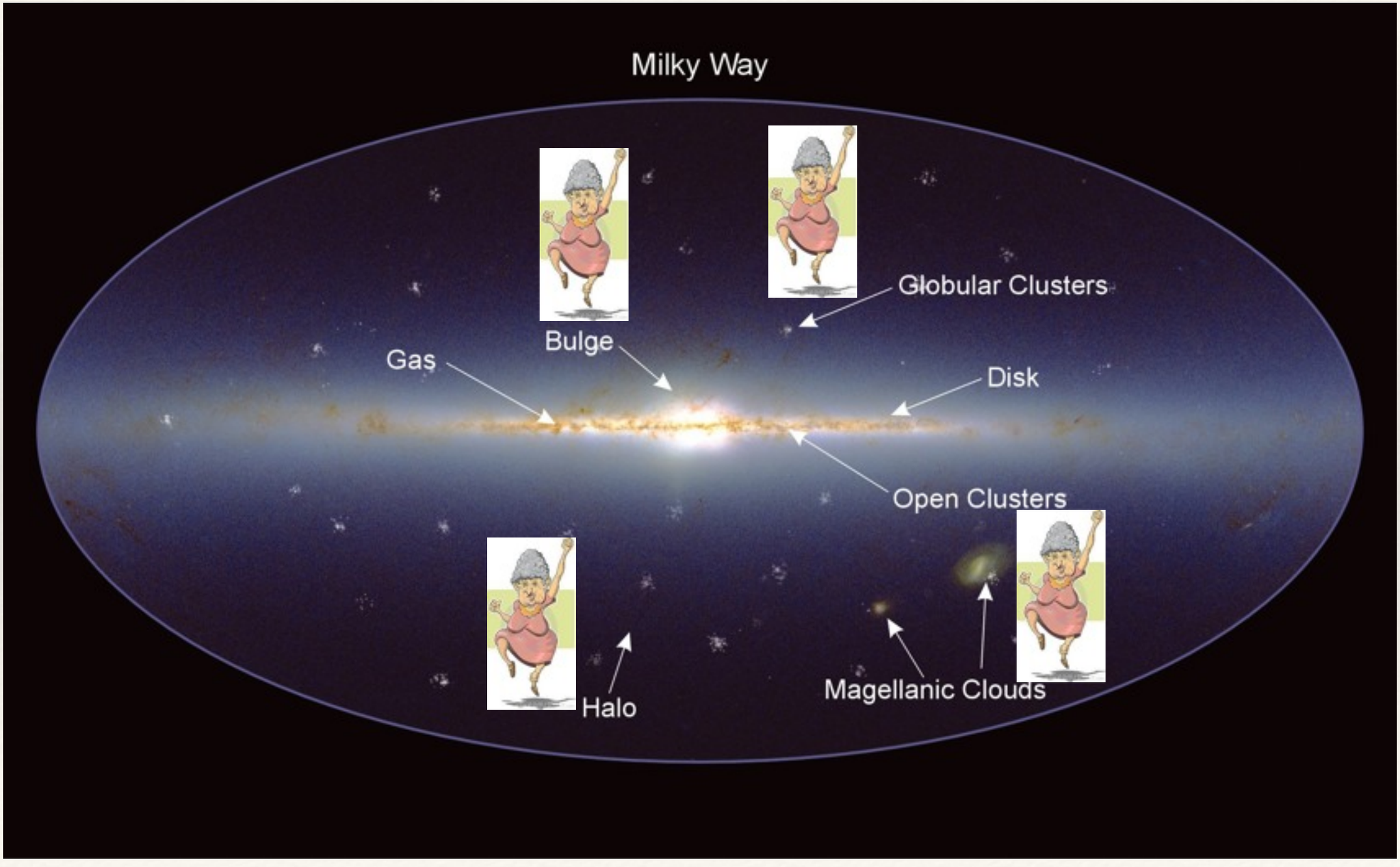

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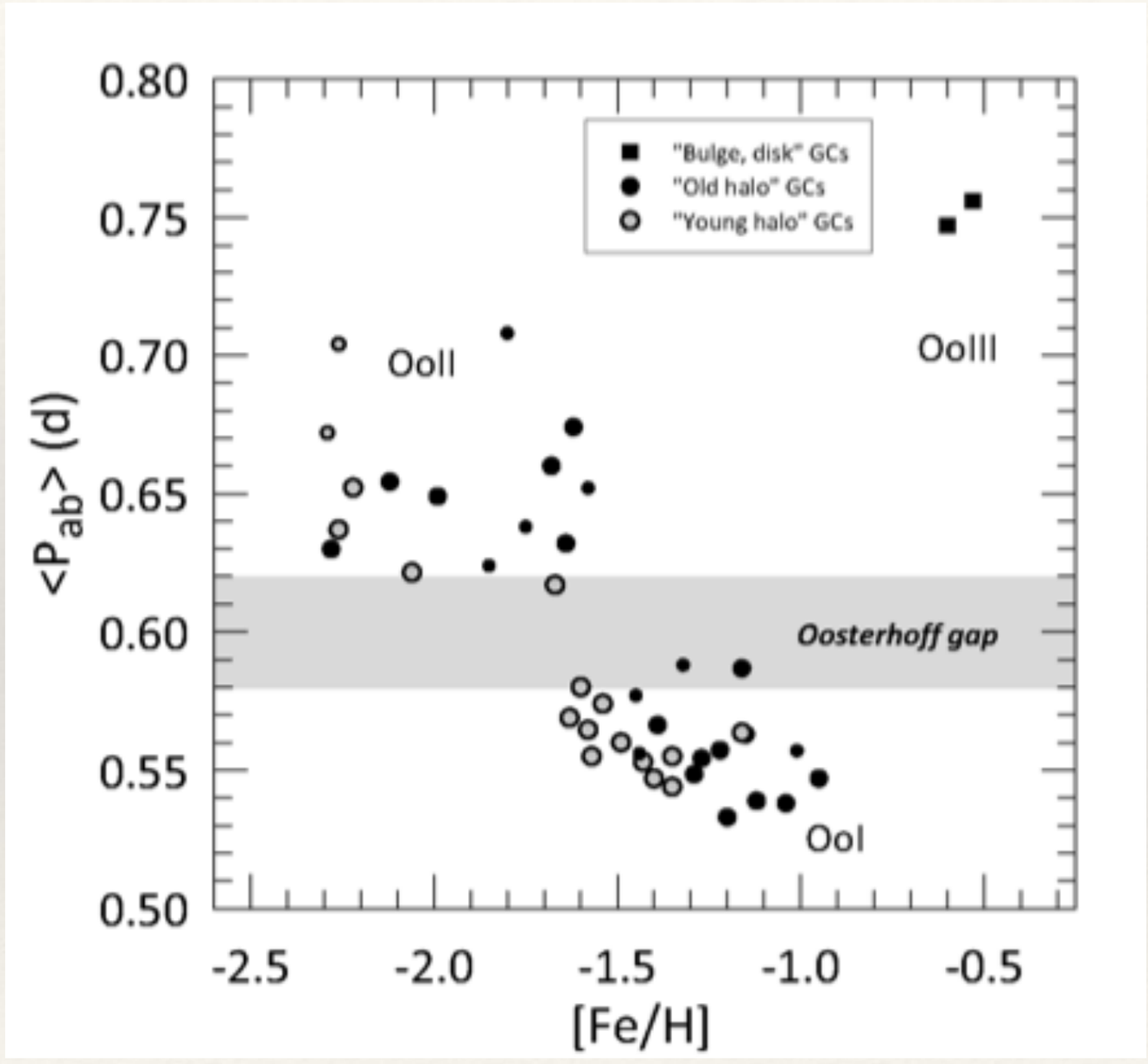
A historical approach, the Oosterhoff dichotomy (1939)



Smith, Catelan & Clementini 2009

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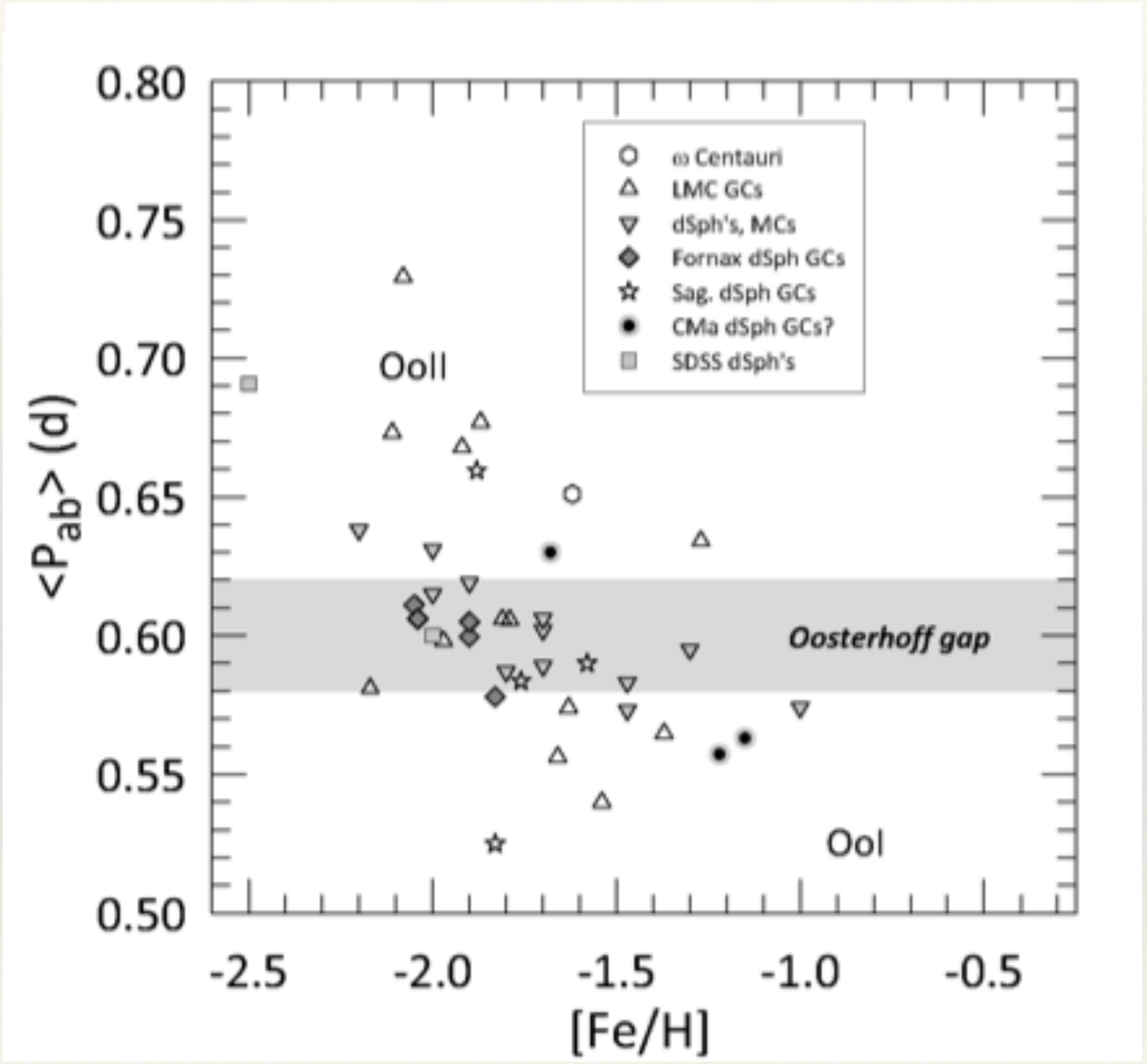

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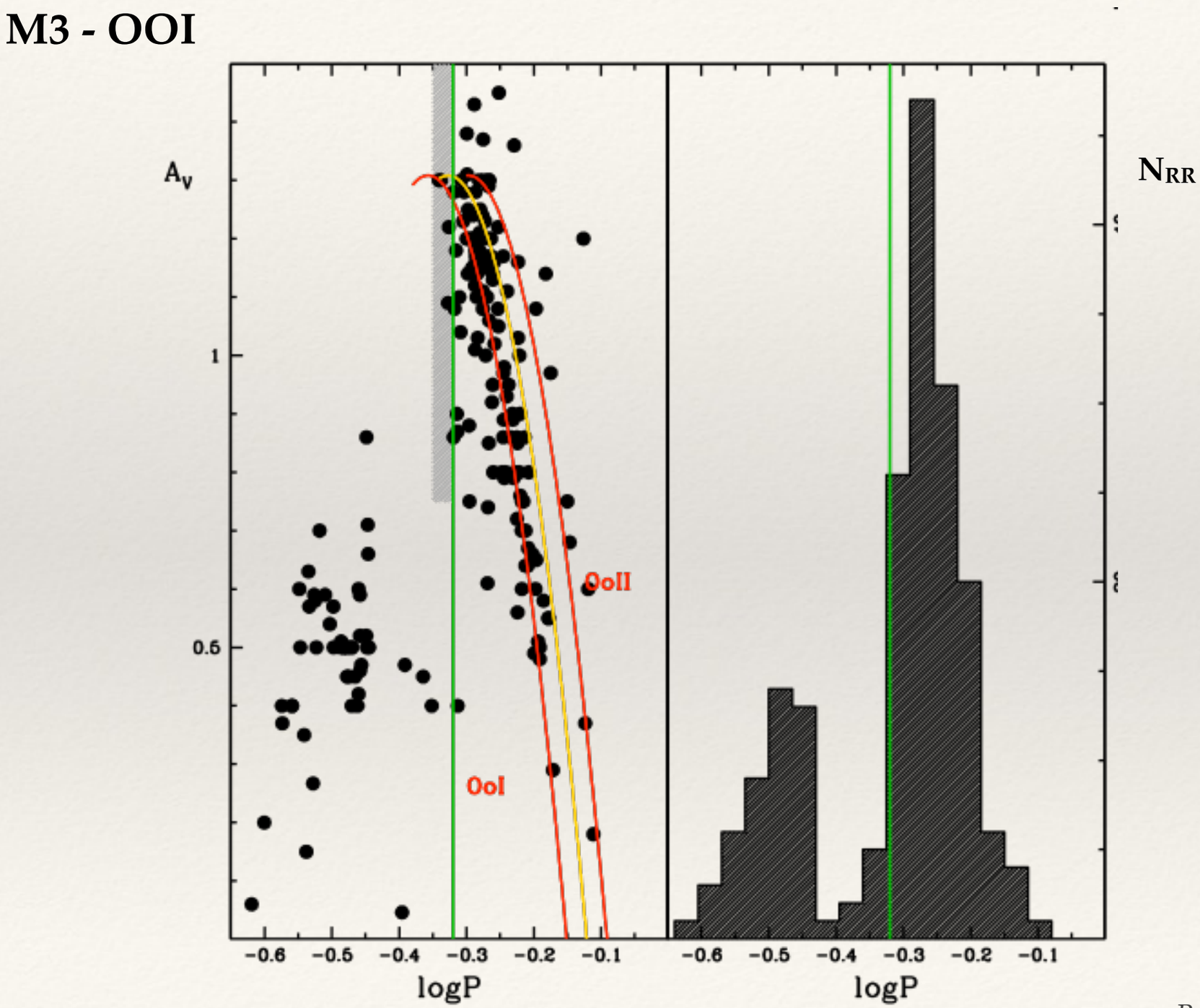
The Oosterhoff dichotomy, another way to see it…
the **period-amplitude** diagram and **period** distribution



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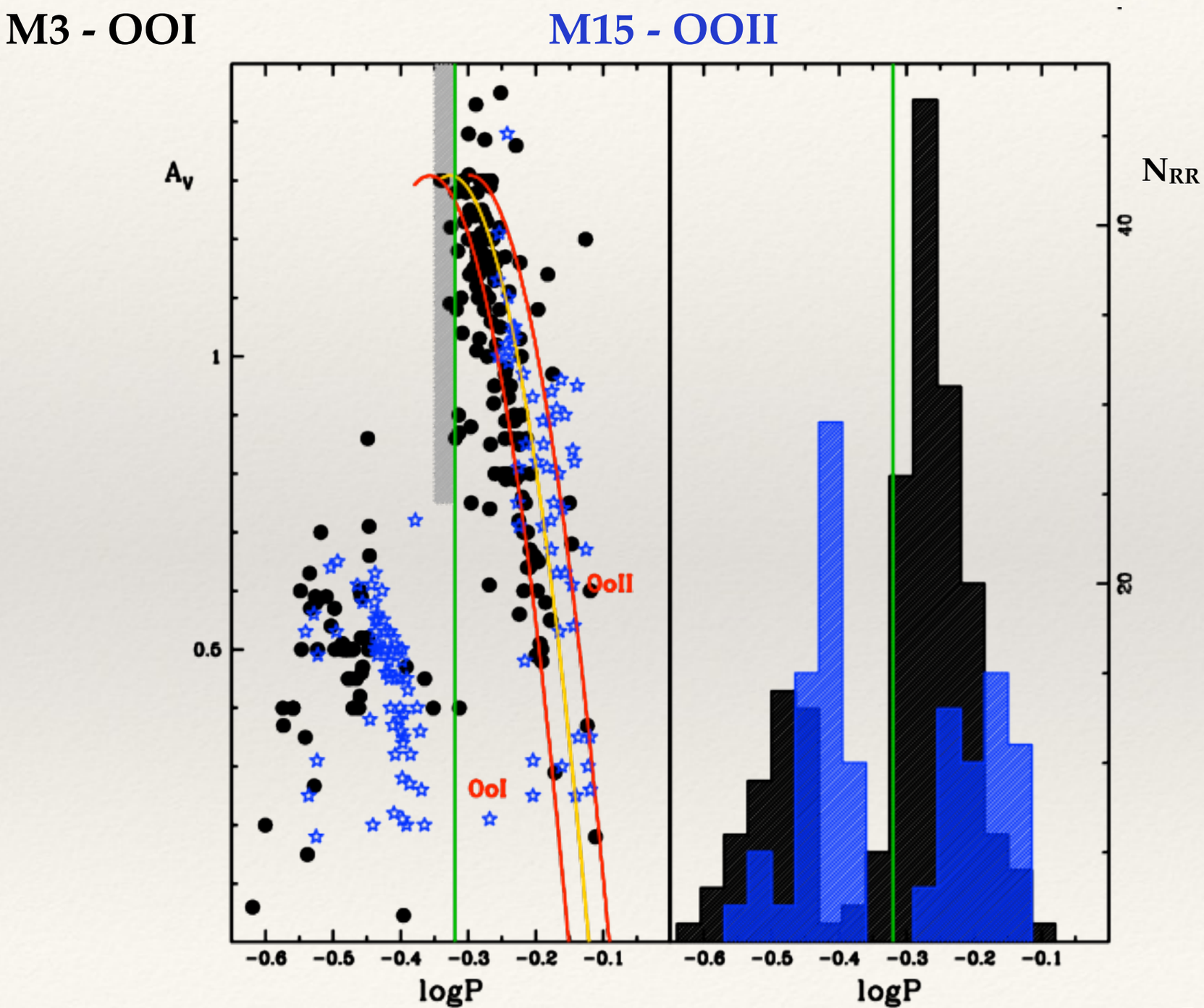

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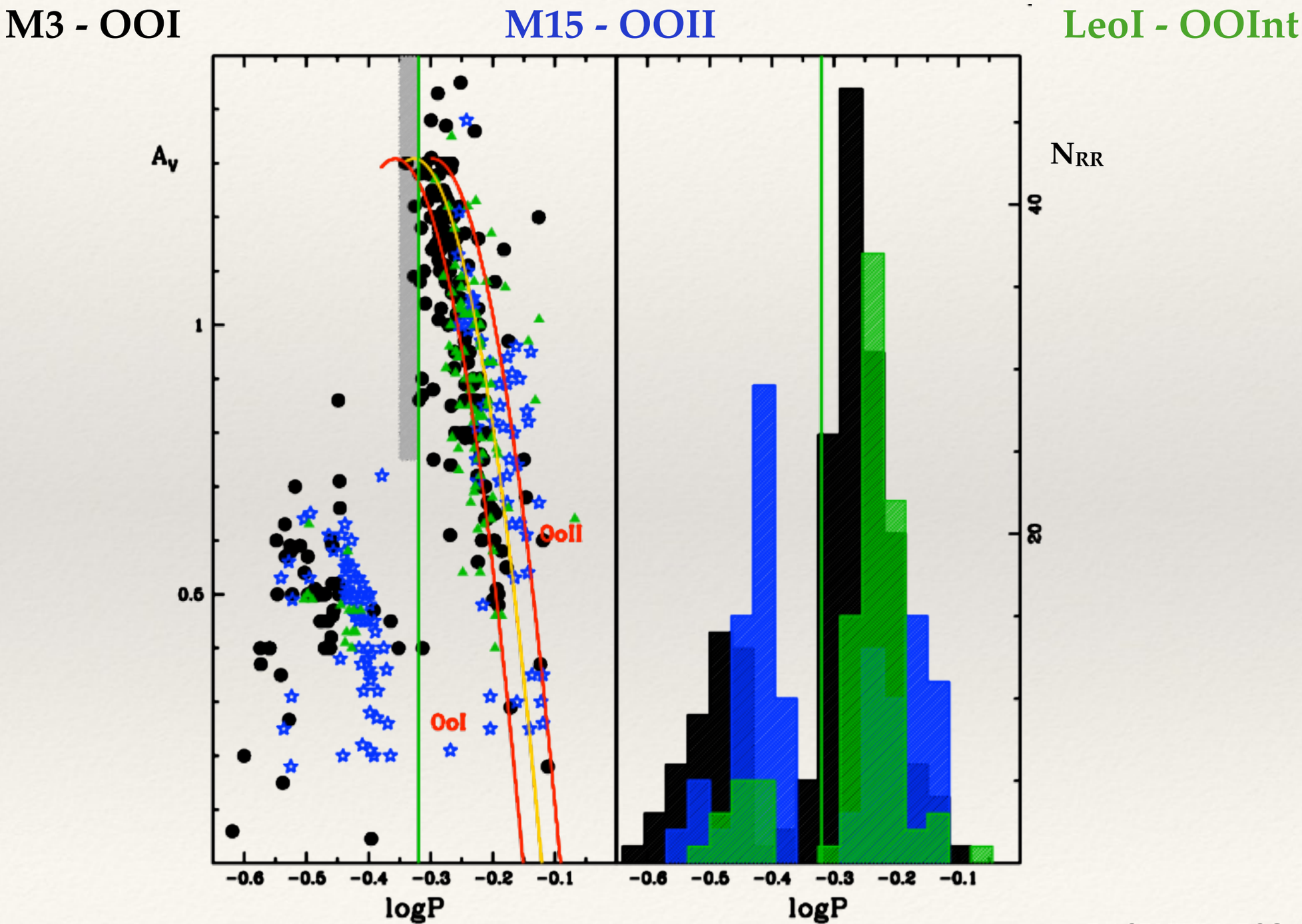
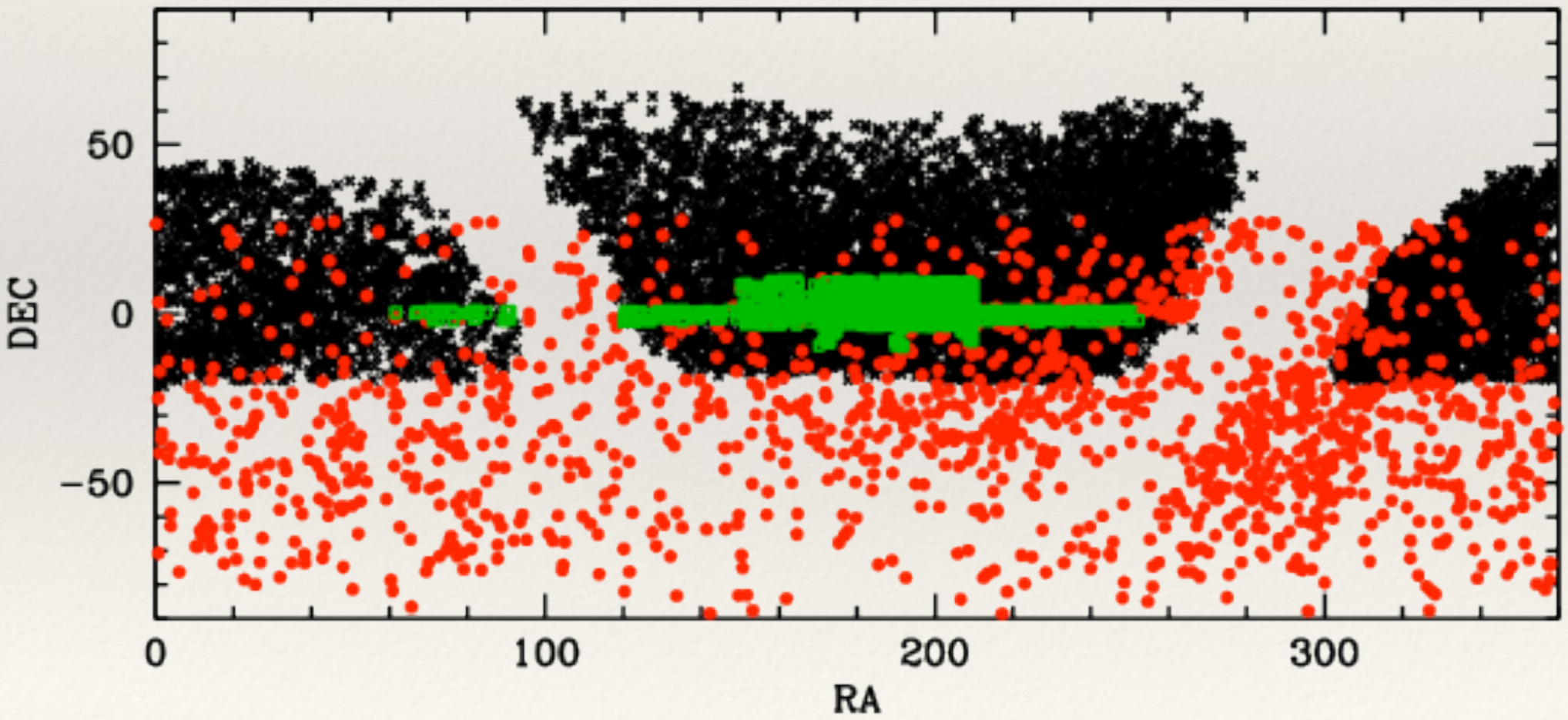


What about the halo RR Lyrae stars?

CATALINA (Drake+13)
ASAS (Szczygiel+09)
QUEST (Zinn+14, Vivas+04)

More than 14’700 stars with V-band, light curves and amplitudes available



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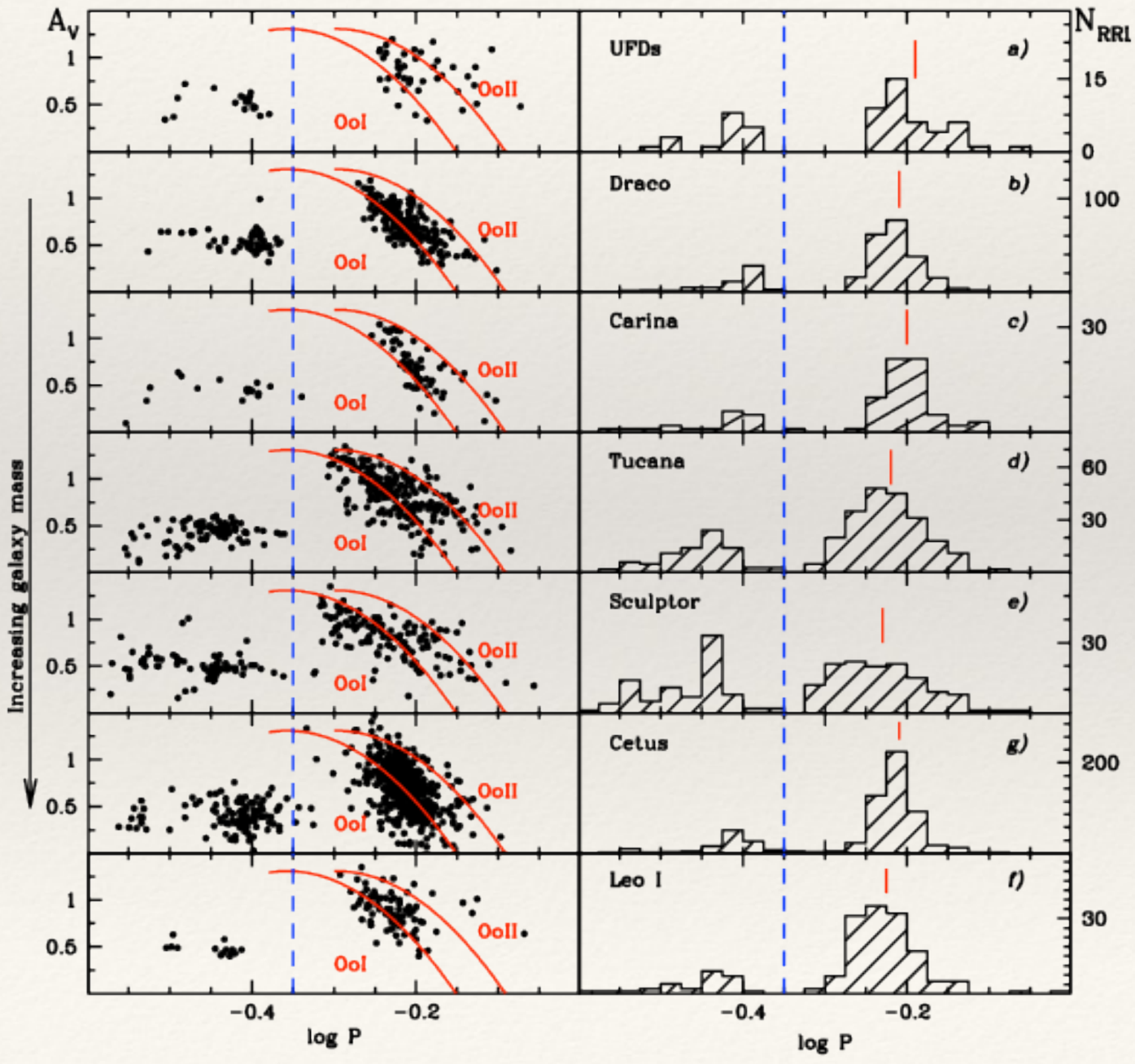
Homogeneous photometry project: dwarf spheroidal galaxies

work in progress with PB Stetson, **M. Monelli, G. Bono**, C. Gallart, E. J. Bernard, **C. Martínez Vázquez**

a large data-base of photometric catalogues

using both proprietary and all the accessible archival data for **classical** dwarfs



Draco

Carina

Tucana

Sculptor

Cetus

LeoI

Stetson, Fiorentino et al. 2014

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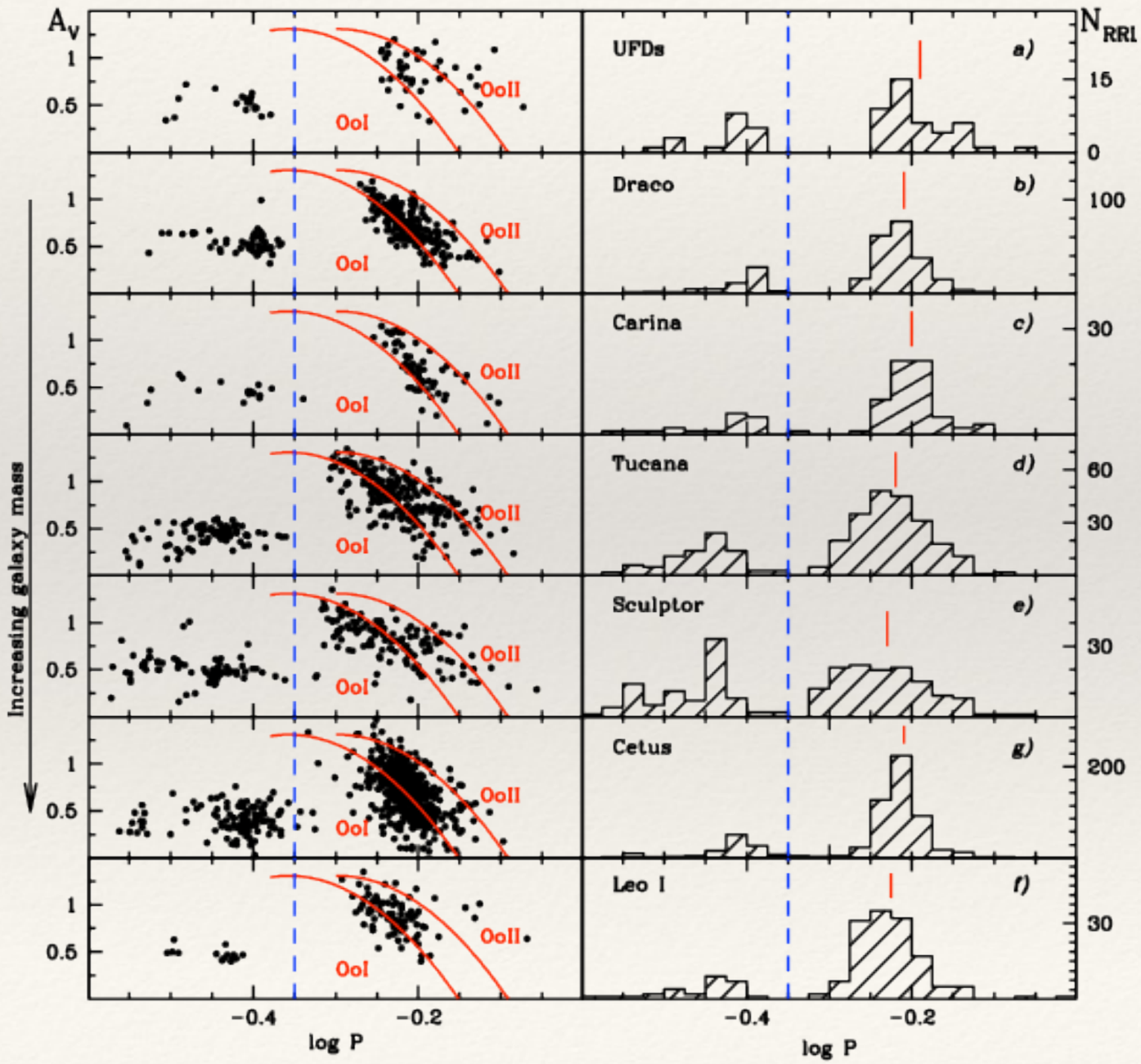

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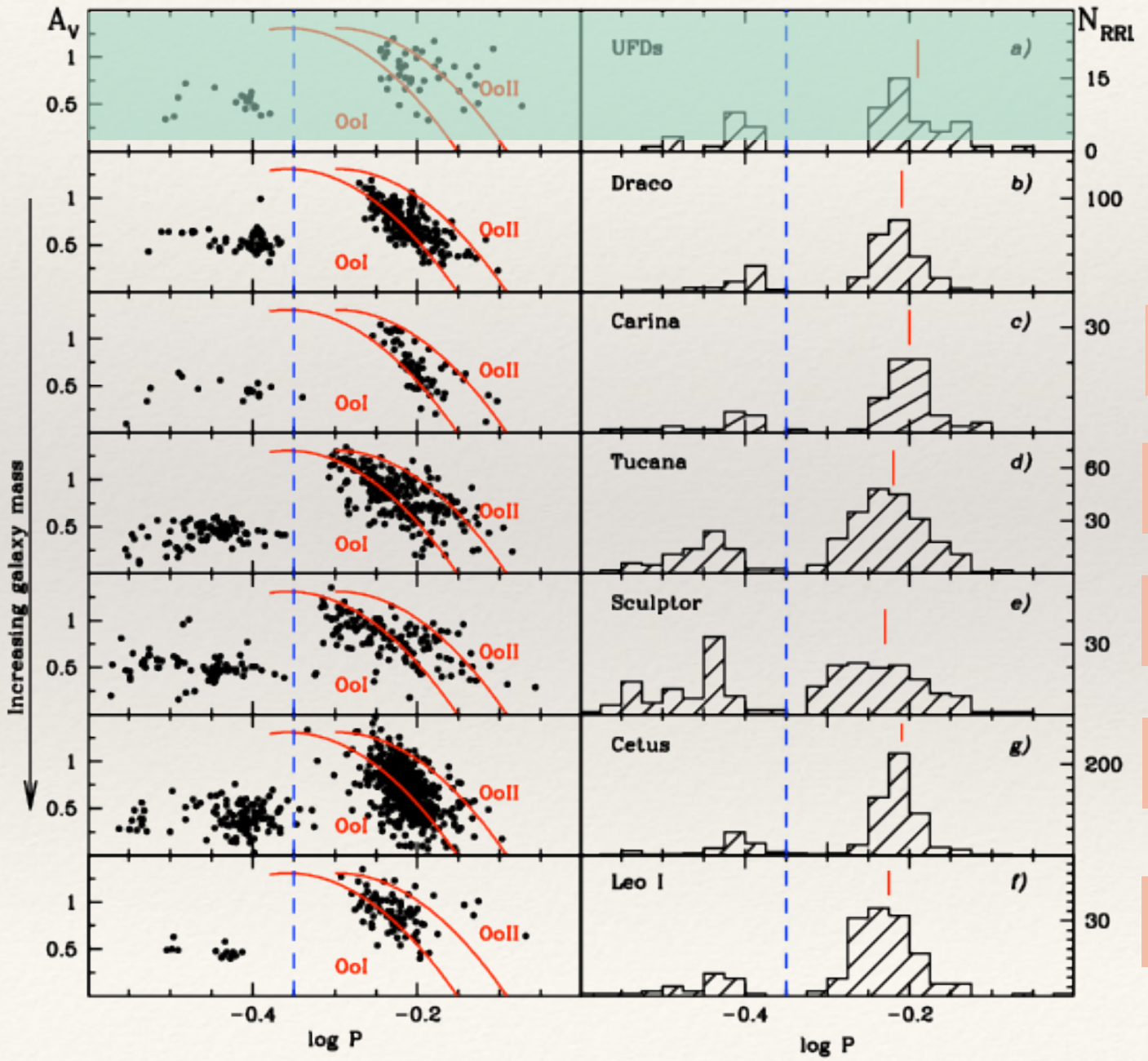

UFDs

Draco

Carina

Tucana

Sculptor

Cetus

LeoI

Siegel et al.2006
Dall'Ora et al.2006
Kuehn et al.2008
Greco et al.2008
Moretti et al.2009
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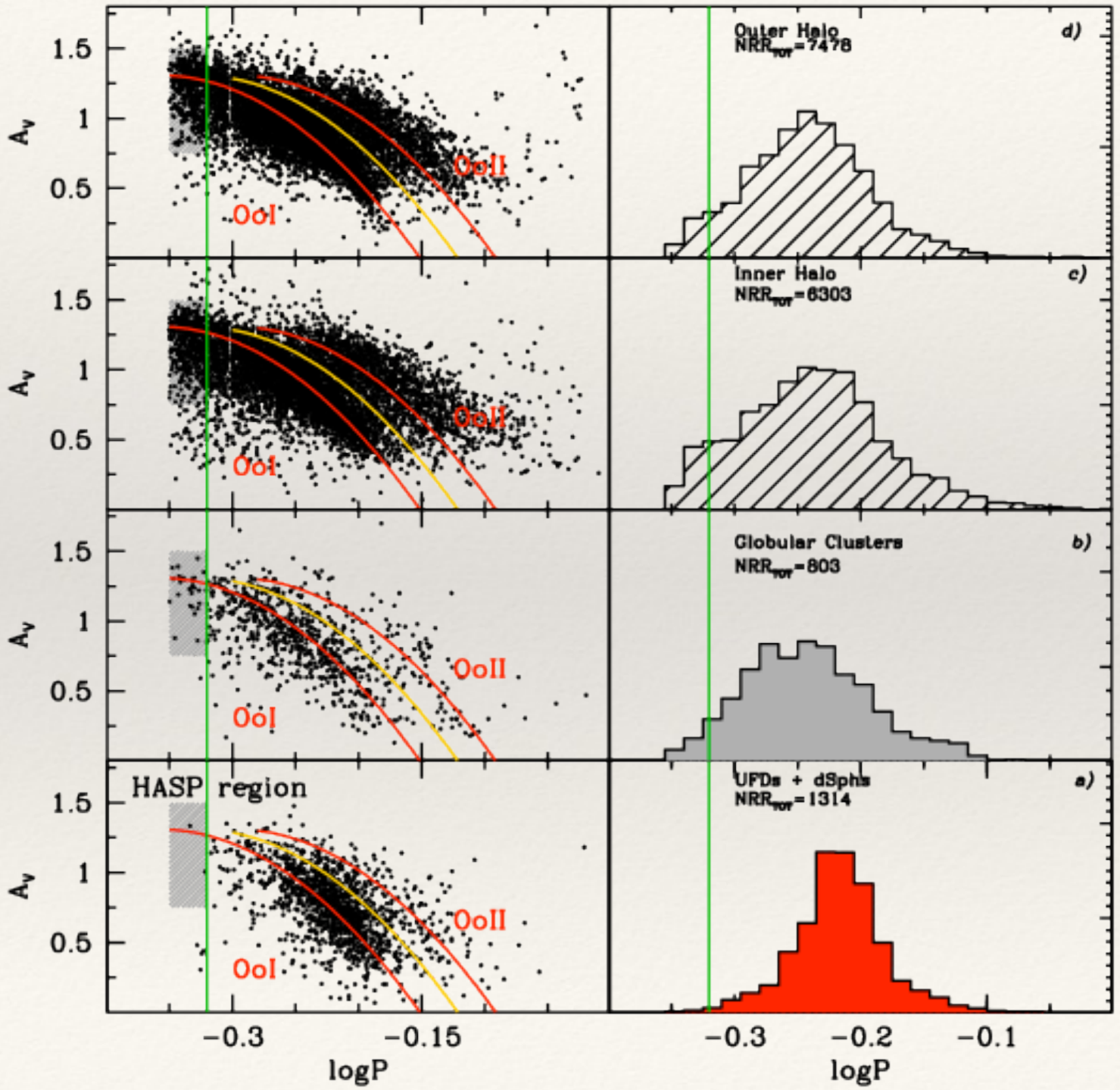
Clementini et al.2012
Garofalo et al.2013
Boettcher et al.2013

First, **DIRECT** comparison

selecting only Fundamental mode RR Lyrae (RRab)



OUTER HALO

<Pab>=0.577 ± 0.001 (0.07)

INNER HALO

<Pab>=0.584 ± 0.001 (0.08)

GGCs

<Pab>=0.580 ± 0.002 (0.07)

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<Pab>=0.610 ± 0.001 **(0.05)**

Fiorentino et al. to be submitted soon!

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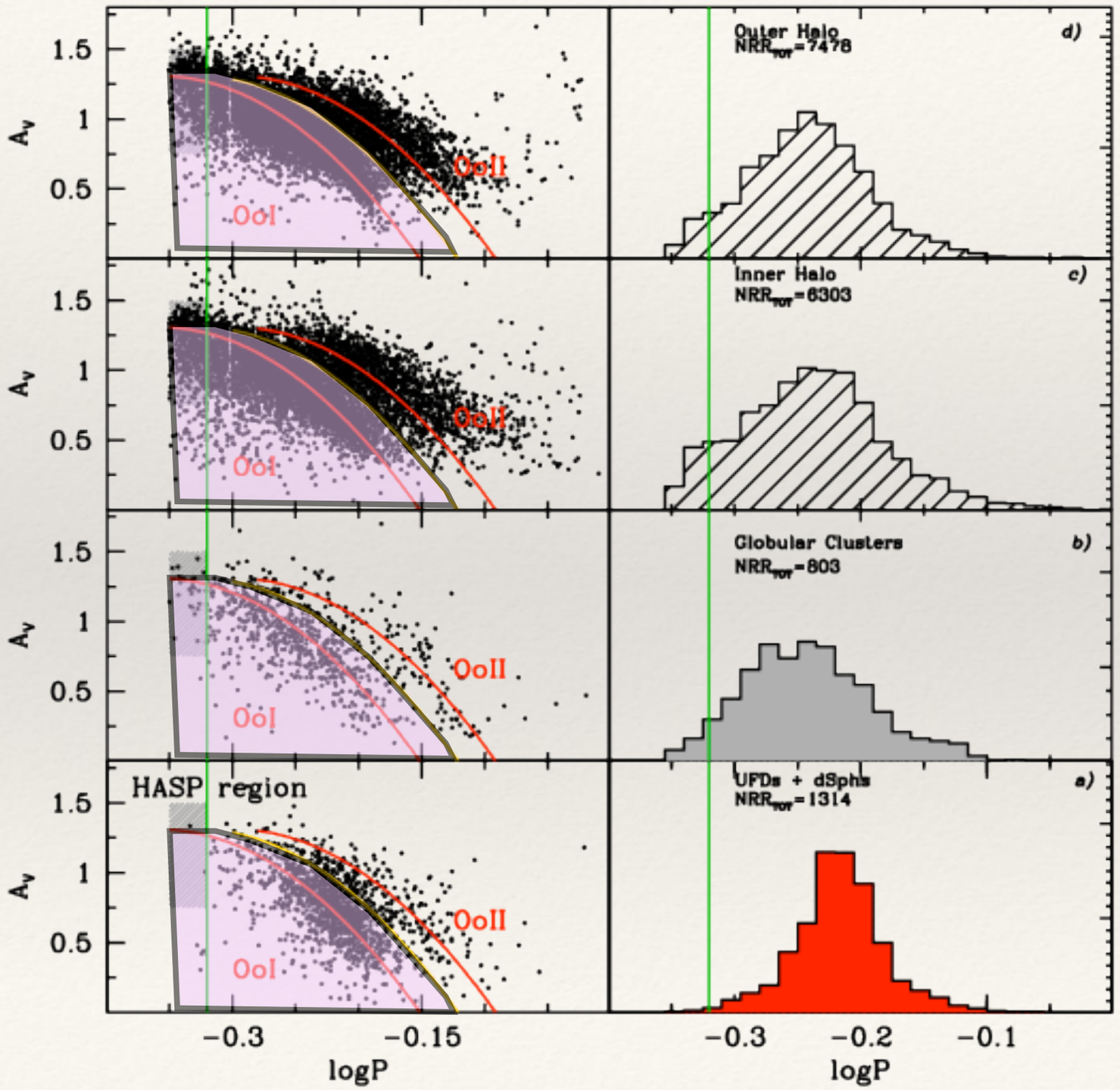

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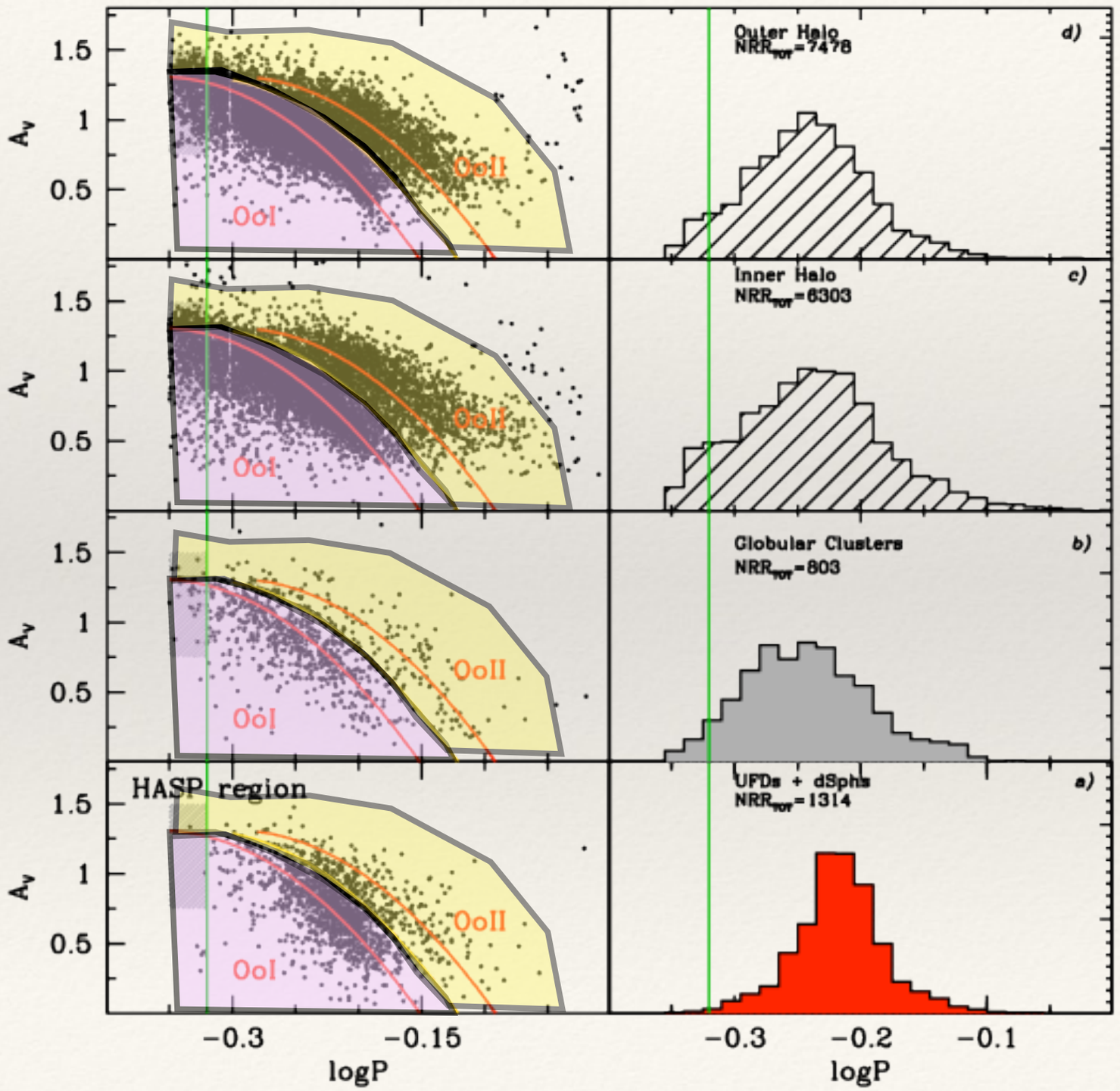

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The High Amplitude Short Period (HASP) RRab are missing!

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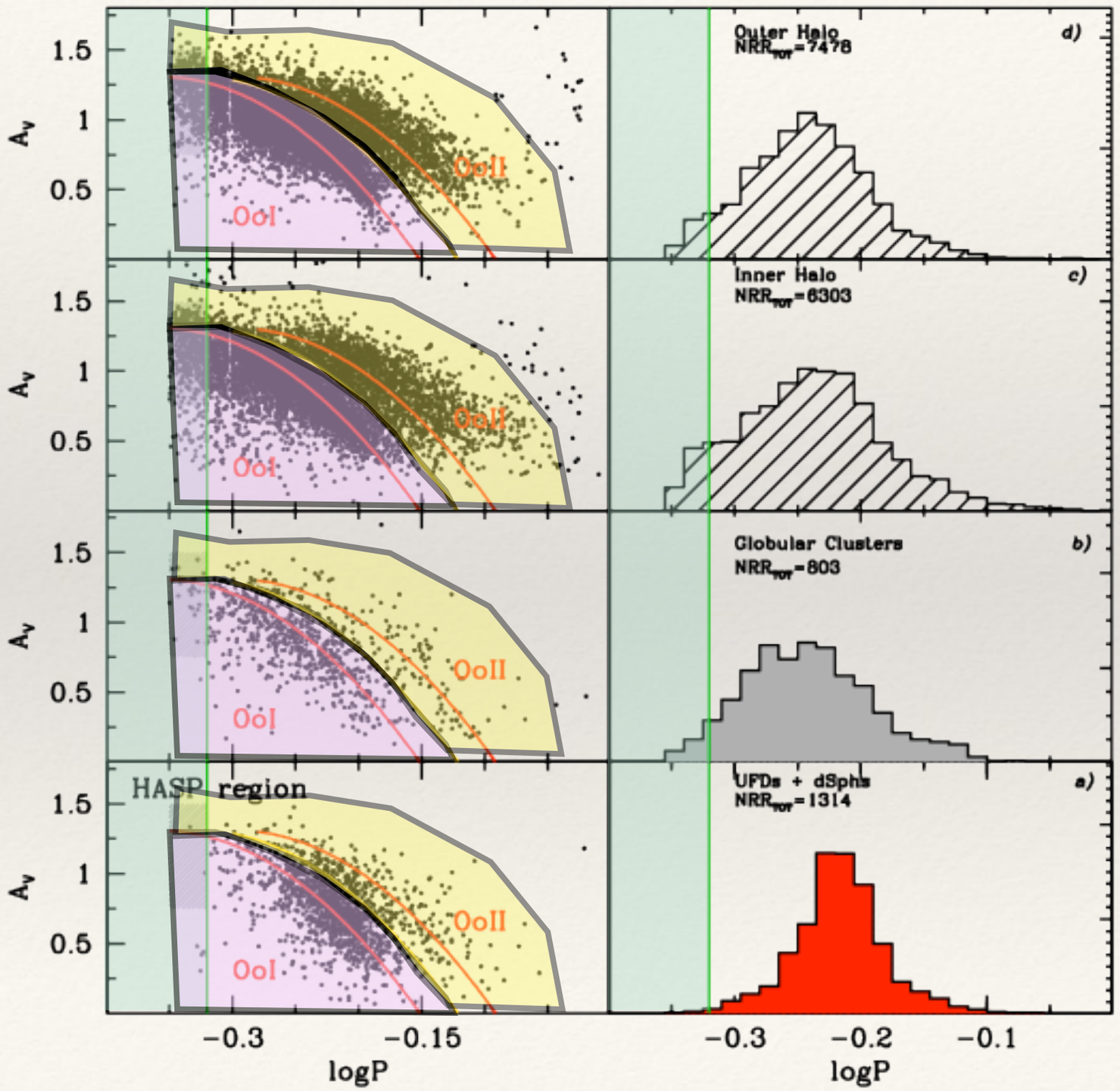

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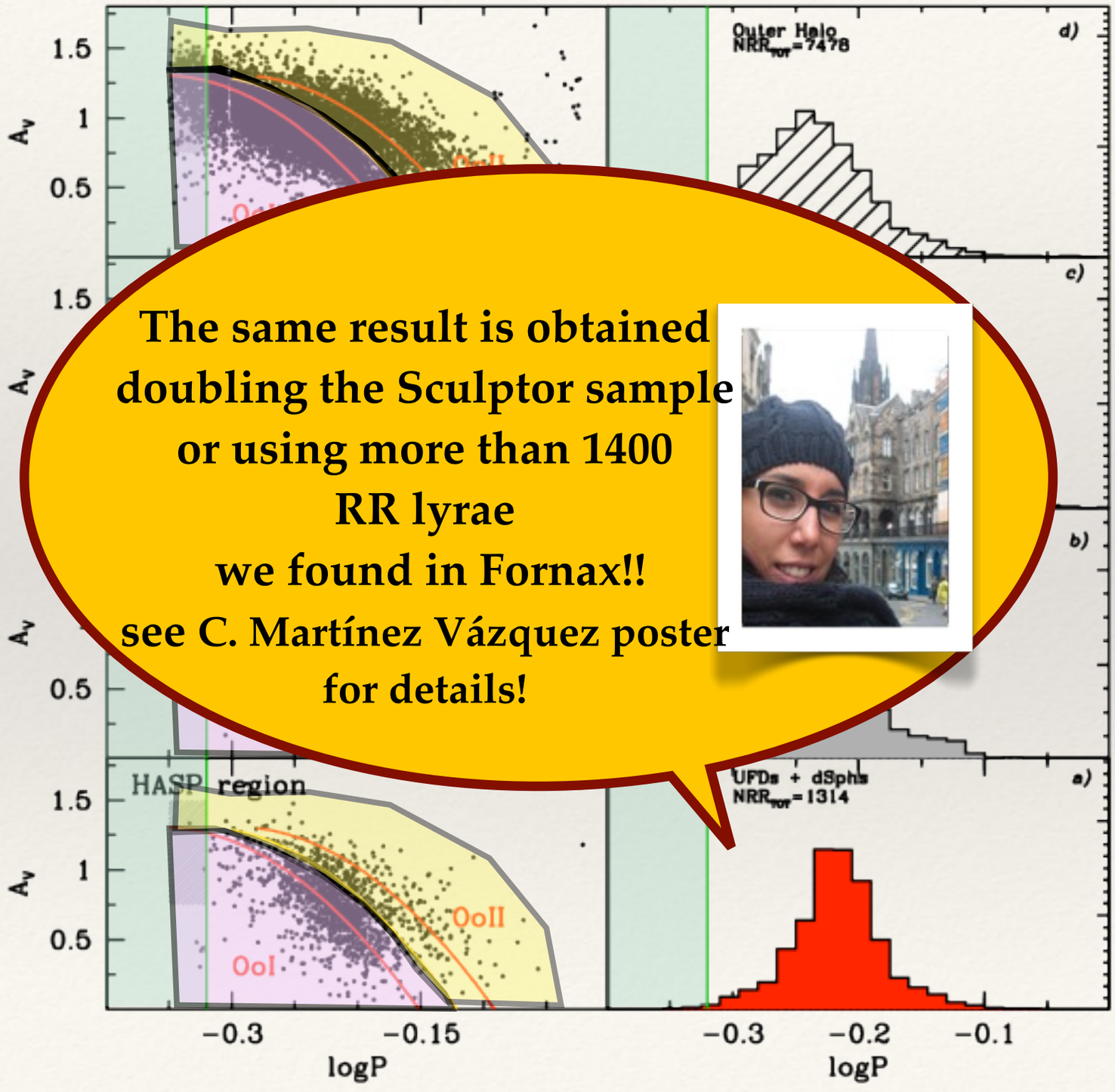

The same result is obtained doubling the Sculptor sample or using more than 1400 RR lyrae we found in Fornax!!

see C. Martínez Vázquez poster for details!

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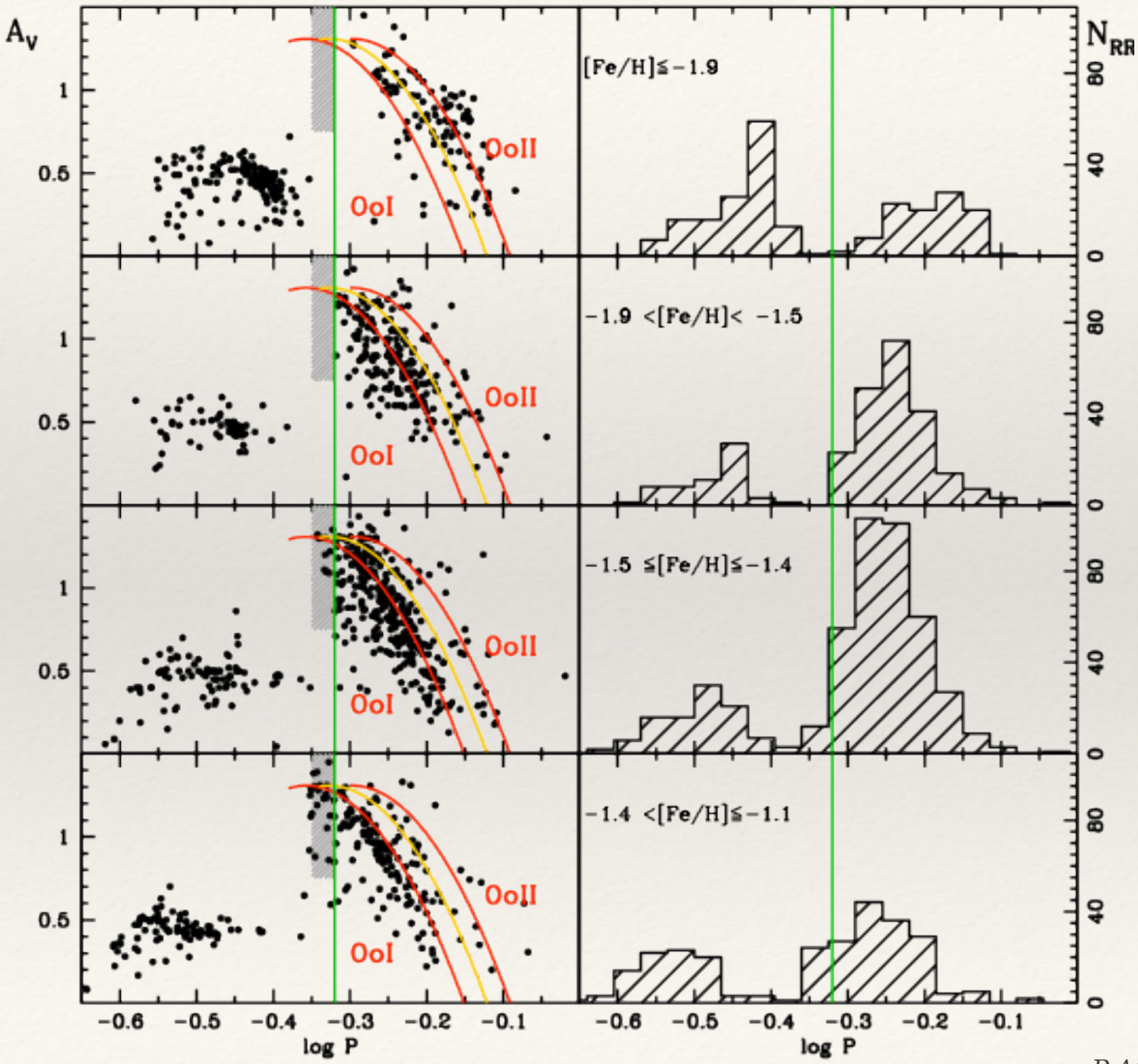

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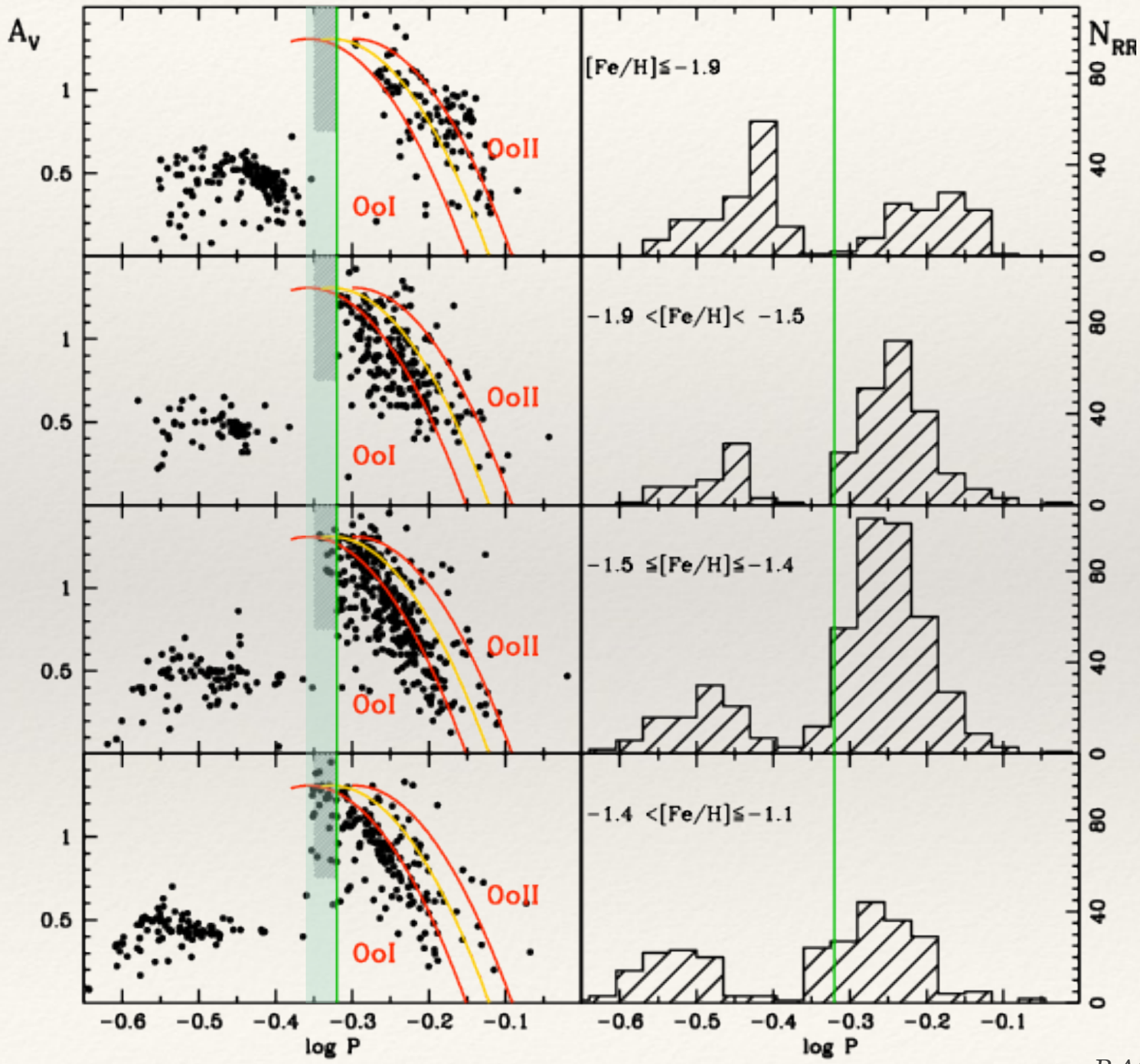

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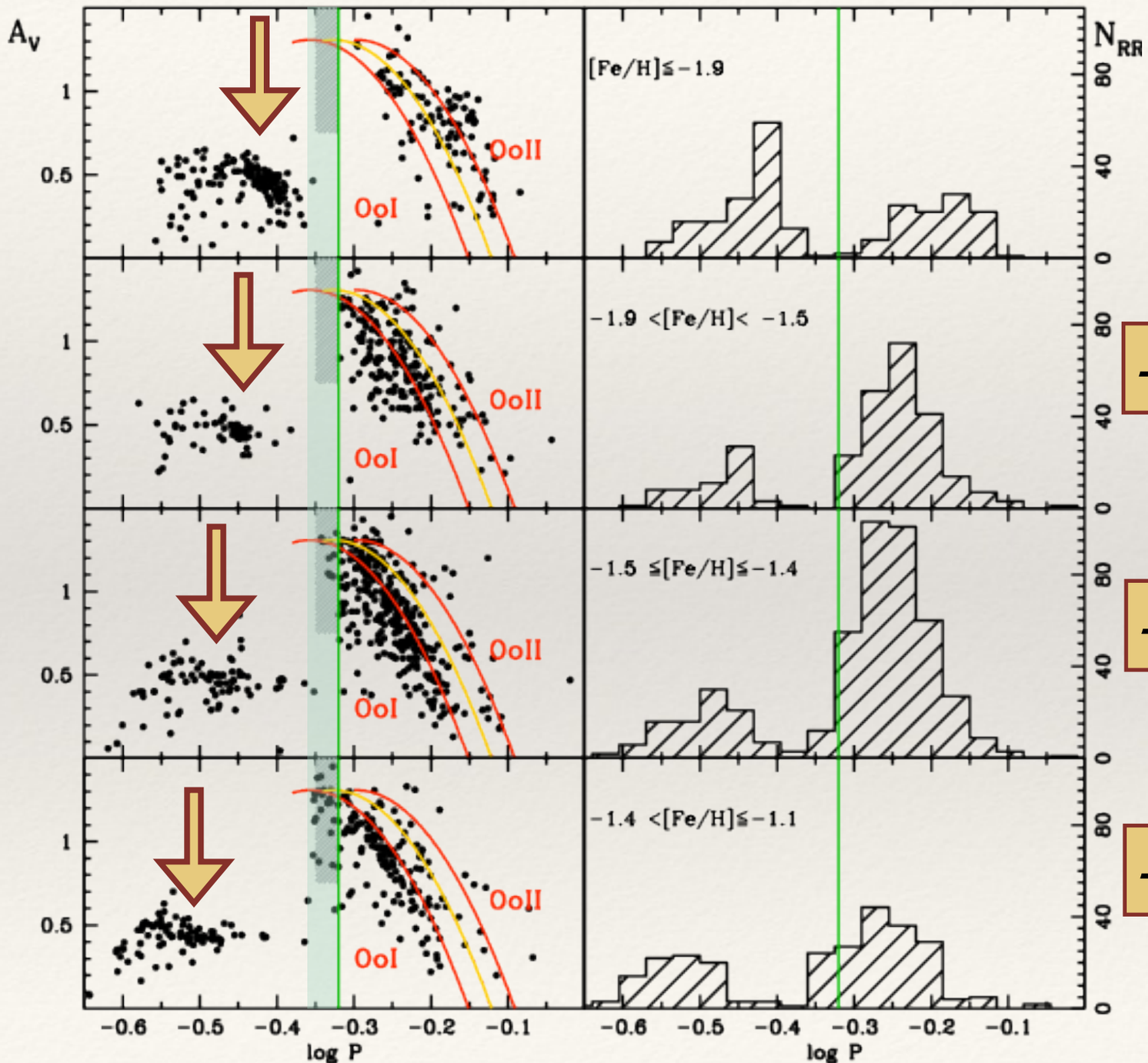

[Fe/H]≤-1.9

-1.9<[Fe/H]<-1.5

-1.5≤[Fe/H]≤-1.4

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HASP appear when increasing the metallicity...

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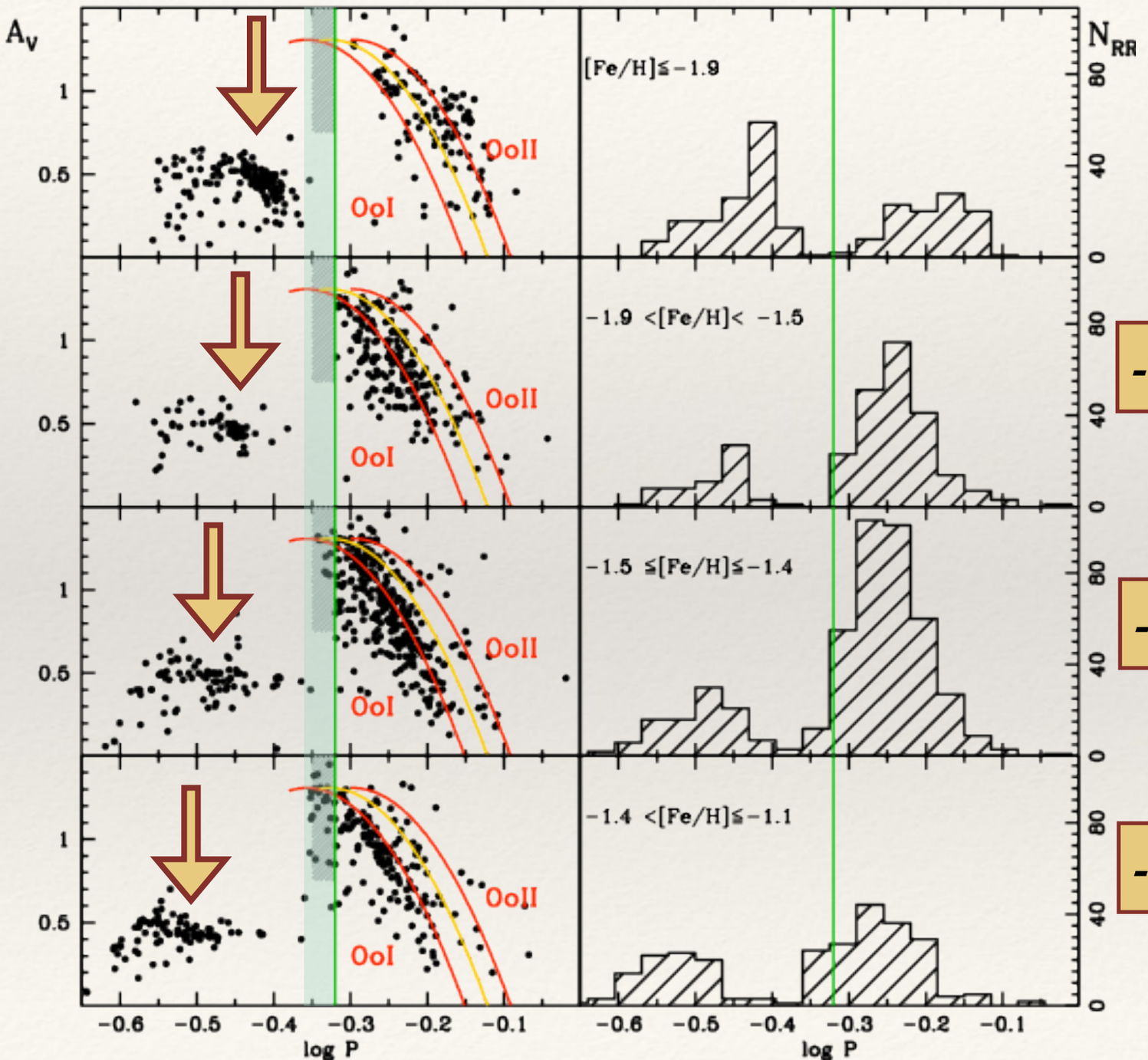

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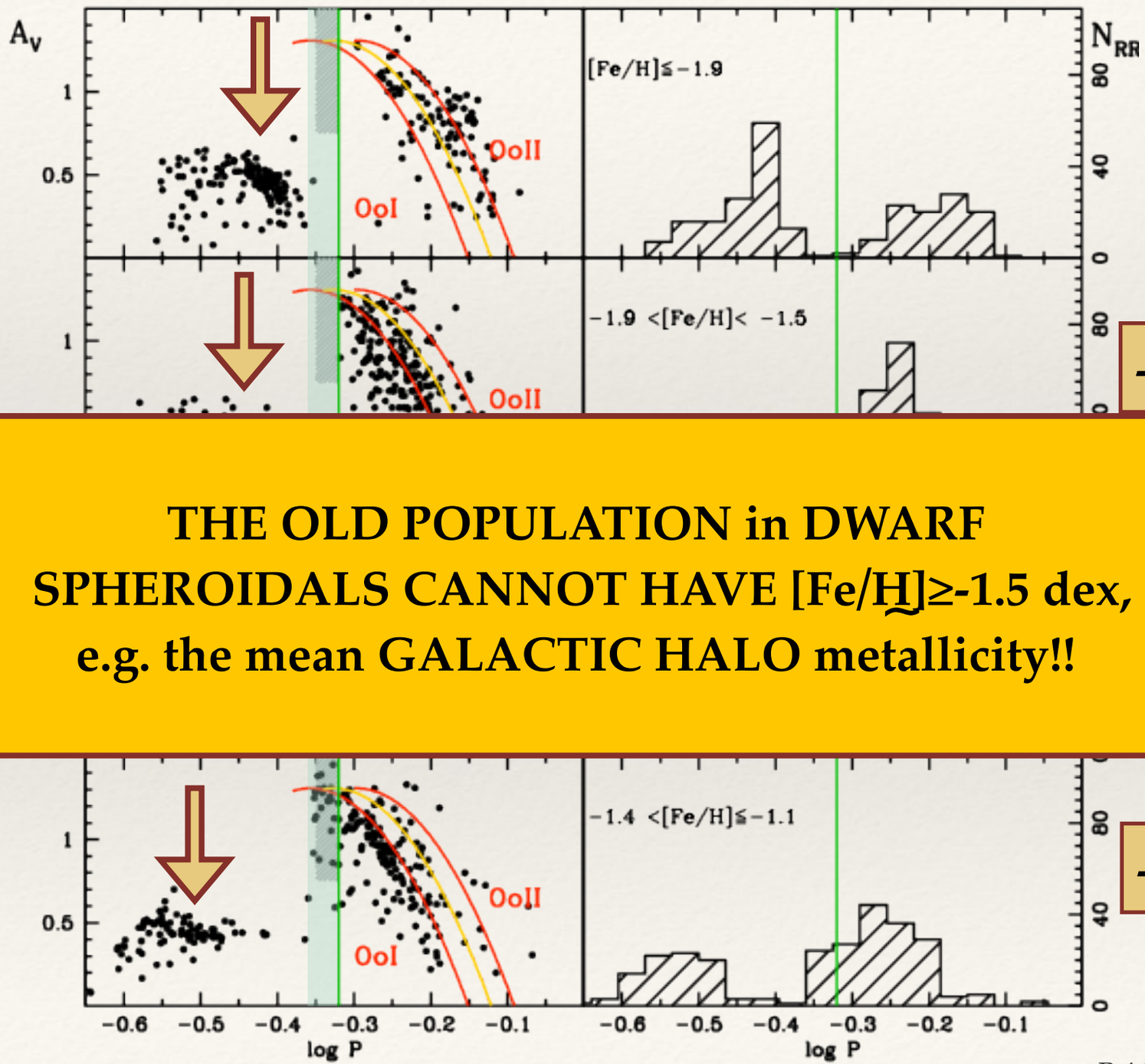

THE OLD POPULATION in DWARF SPHEROIDALS CANNOT HAVE [Fe/H]≥-1.5 dex, e.g. the mean GALACTIC HALO metallicity!!

[Fe/H]≤-1.9

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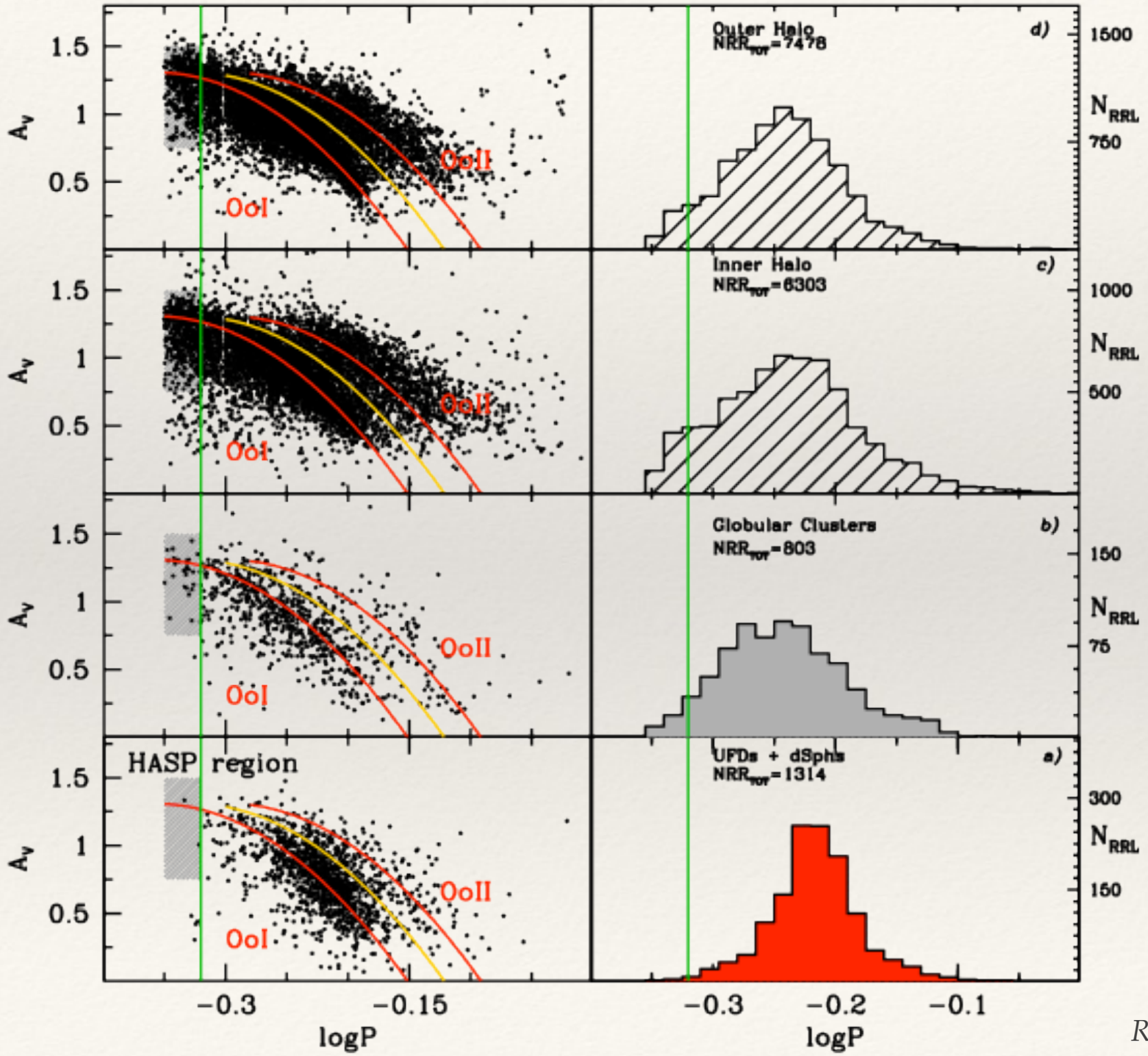
Conclusion I: Building-up the Galactic halo with dwarfs

Fiorentino et al. to be submitted soon!



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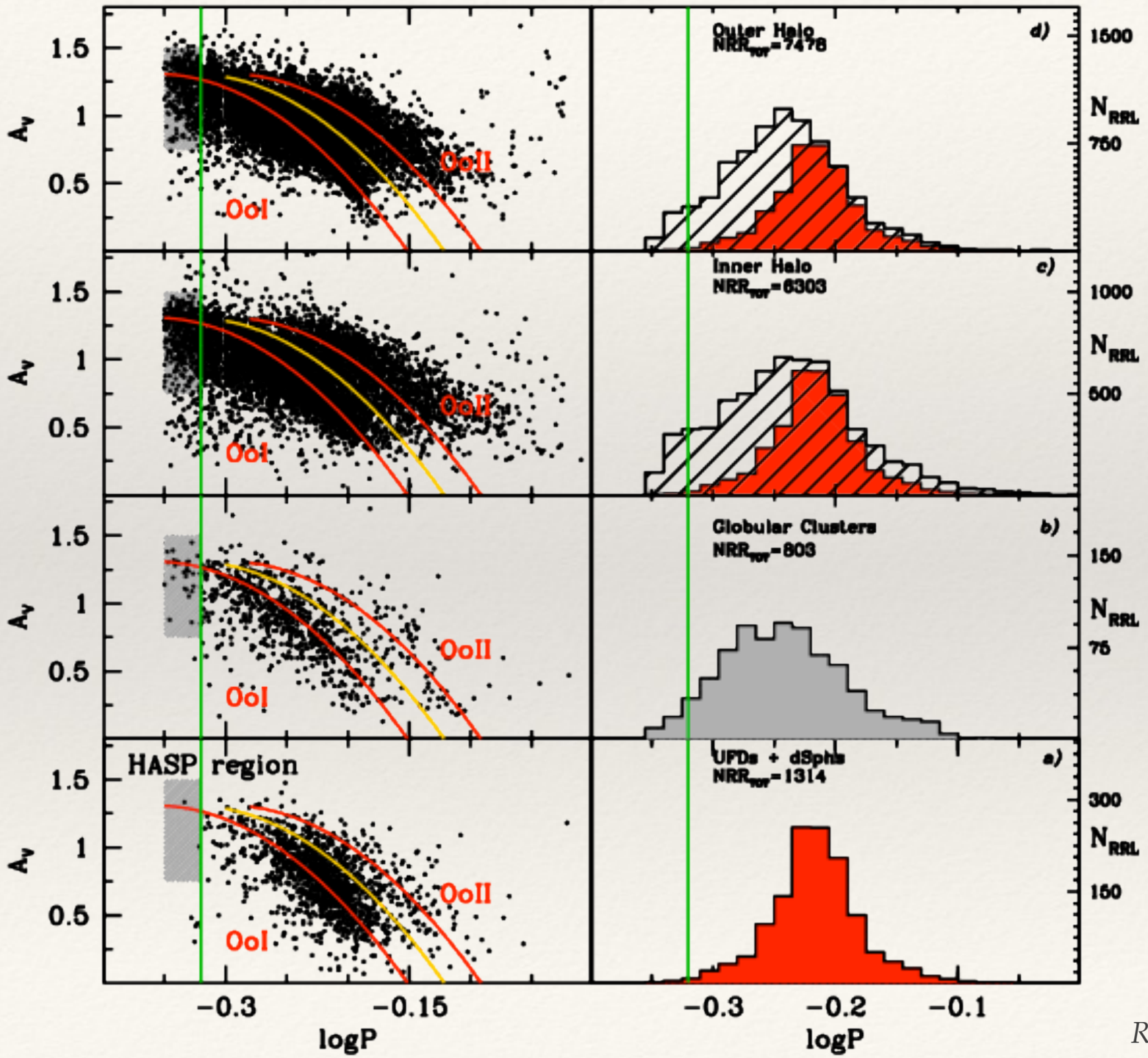

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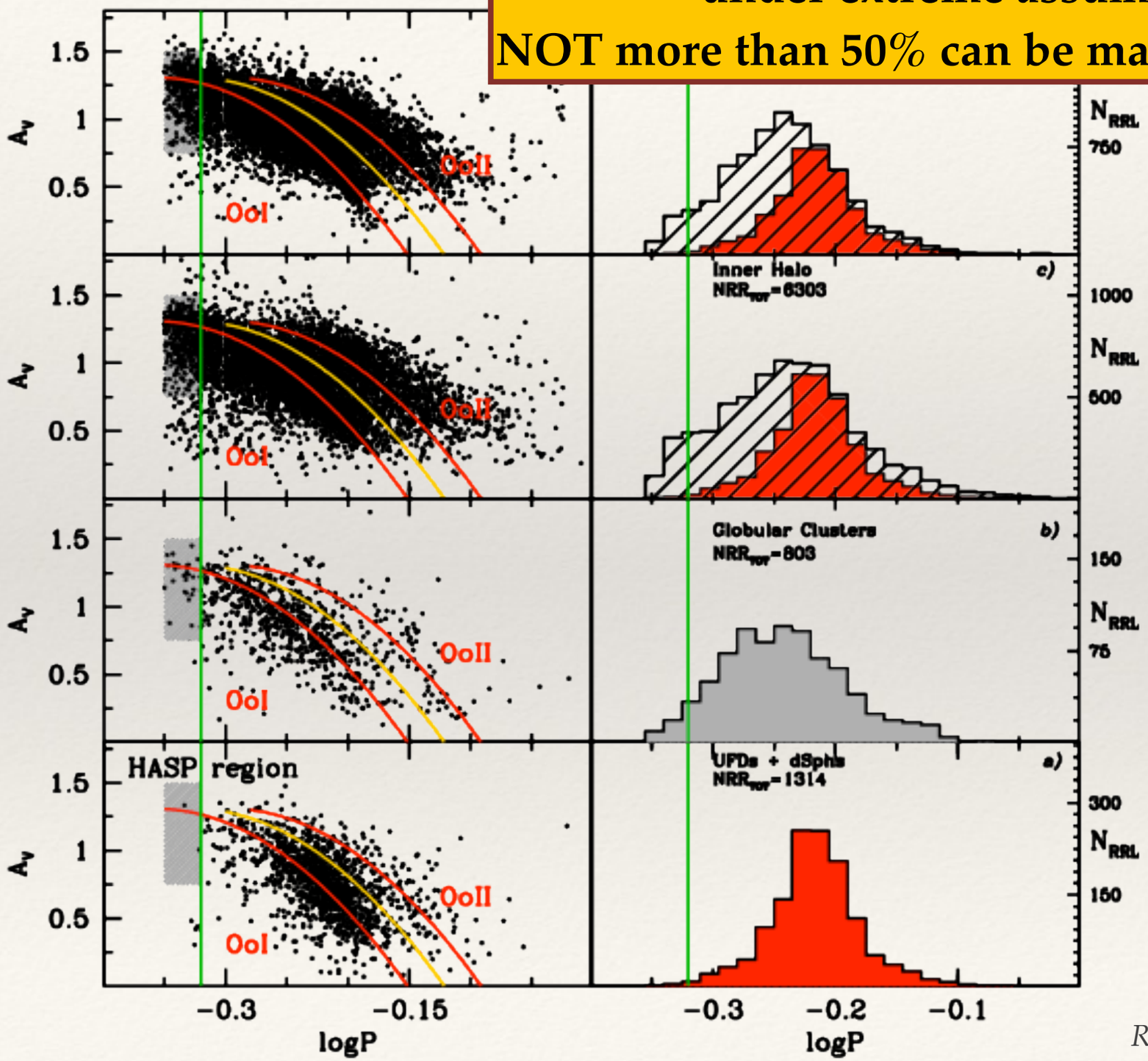
Conclusion I: Building-up the Galactic halo with dwarfs

under extreme assumptions:
NOT more than 50% can be made from dwarfs!!



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Conclusion II: …and in other galaxies?

$P<0.48$ d and $Av> 0.75$, i.e. $A_{F606W}>0.69$ and $A_I>0.47$

$A_{F606W}/A_V=0.92$ (Brown et al. 2004), $A_I/A_V=0.63$ (Di Criscienzo et al. 2011)

	SMC	LMC	M31	M32	M33	HALO	dSPhs	BULGE
$\frac{N_{HASP}}{N_{RRab}}$	3%	7%	6-11%	8%	5%	14%	0%	17%

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HASP could become a smart tool to constrain the metallicity of the old population in far away galaxies!

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THANKS for your attention

...a lot to learn from the elders

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