What we do not know about the halo

Ralph Schönrich (MPA)

with

Martin Asplund, Luca Casagrande, Heather Morrison

See arxiv:1012.0842

The issue

Sample

SEGUE DR7 calibration stars

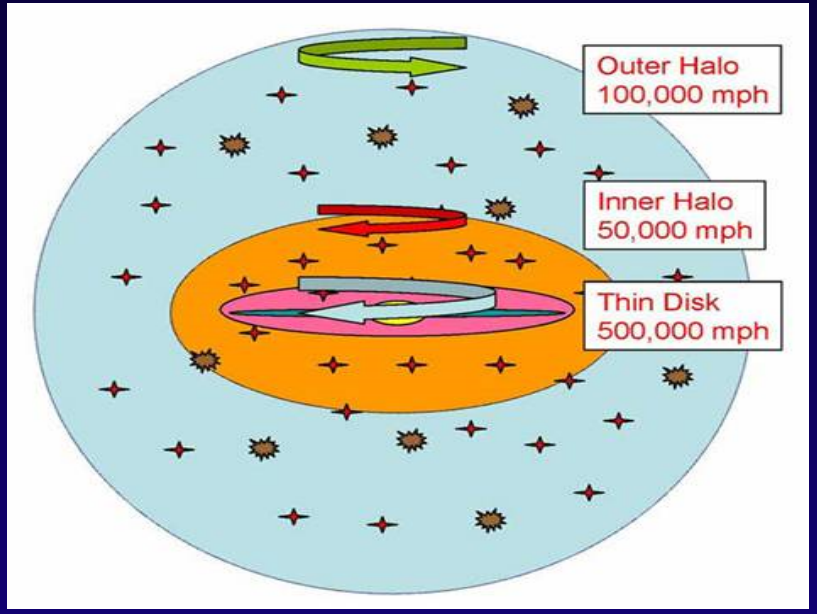
~ 33000 metal poor stars (metallicity bias, no kinematic bias)

- biased towards lower metallicities
- kinematics not biased against metallicity

Two distance scales:

Carollo et al. (2010) ⟷ Ivezic (2008)

(based on Beers et al. 2000)



?

Claims by Carollo et al. (2007, 2010)

10-20% distance errors

- Achieved by sorting stars into stellar branches

Gaussian analysis applicable

Three disc components

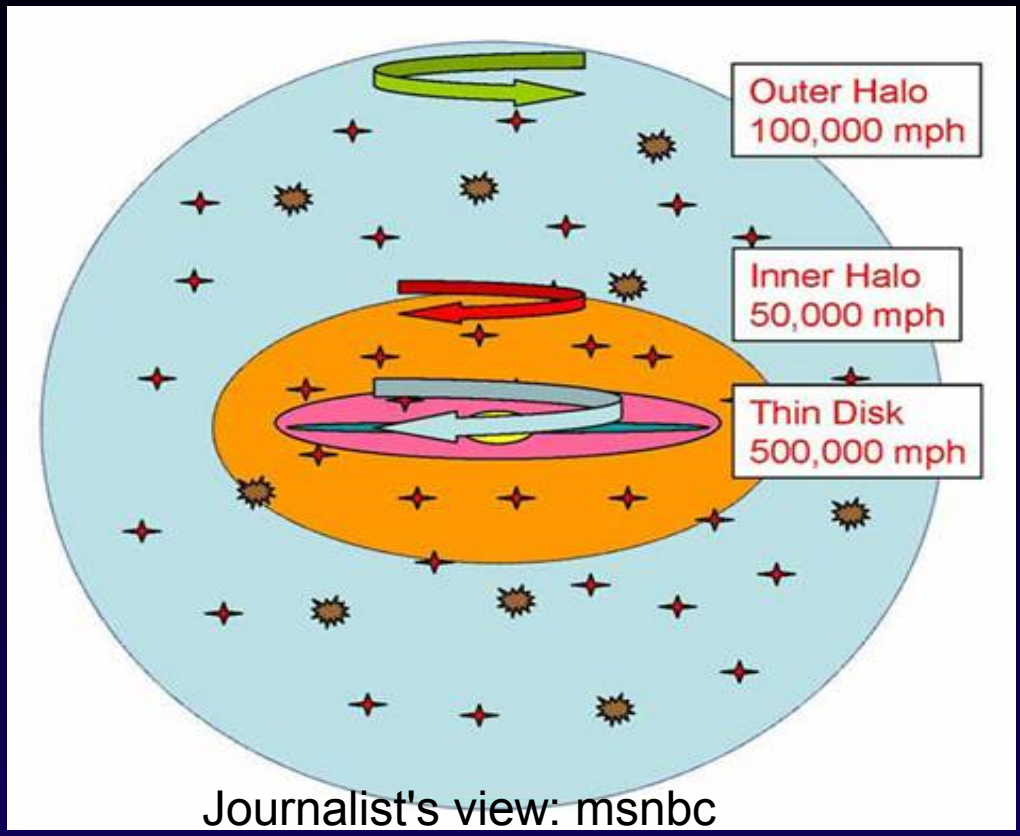
Two halo components

Distinct outer halo component

More metal poor

Very high vertical velocity dispersion

Retrograde motion



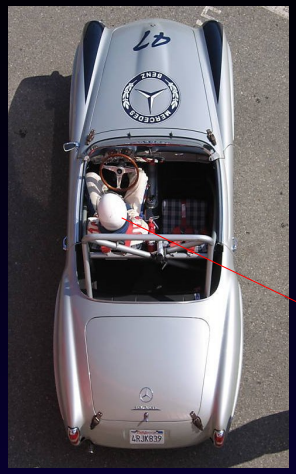
Journalist's view: msnbc

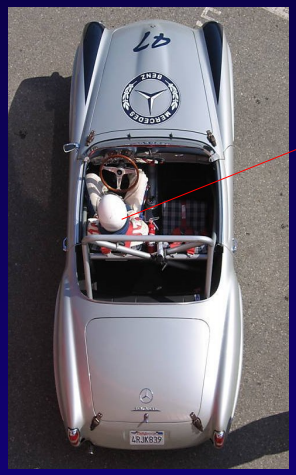
How to make trees run...

How to make trees run...
(if you are not J.R.R. Tolkien)



How to make trees run...



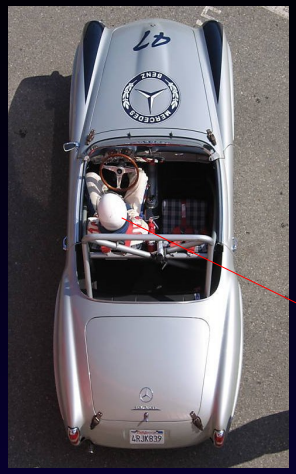


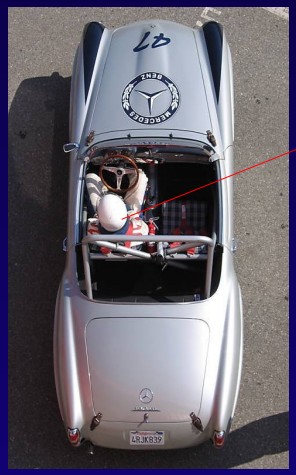


How to make trees run...

Over/-underestimate the distance!

Proper motion must not be aligned with the line of sight

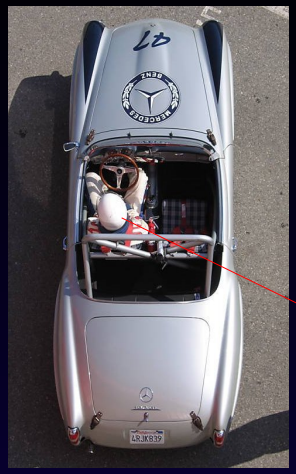








How to make trees run...

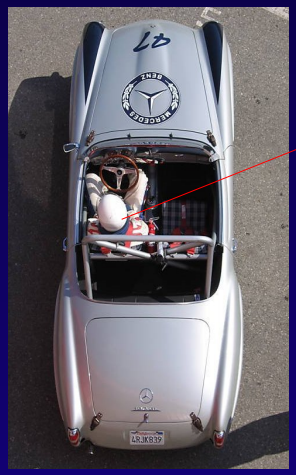


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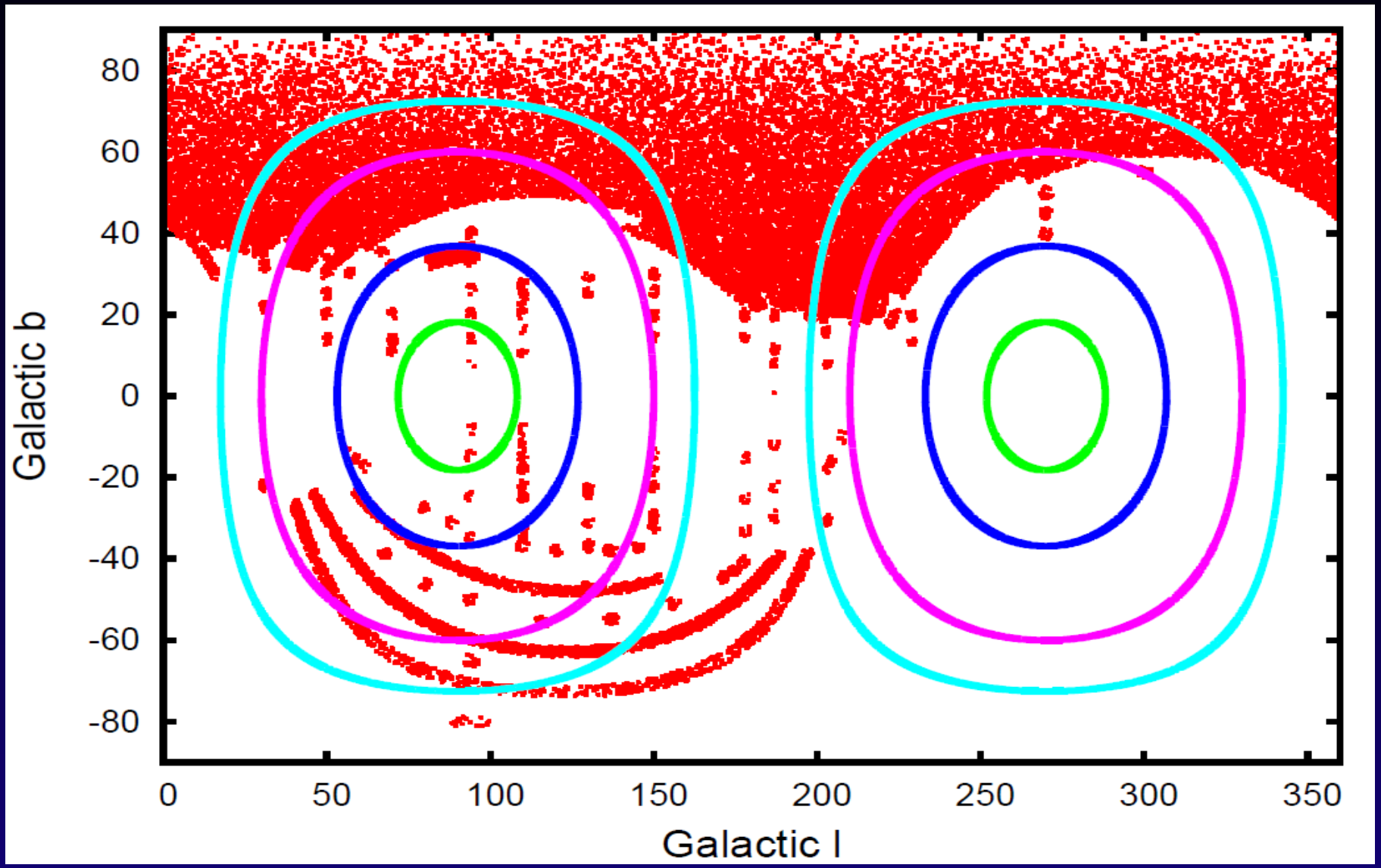




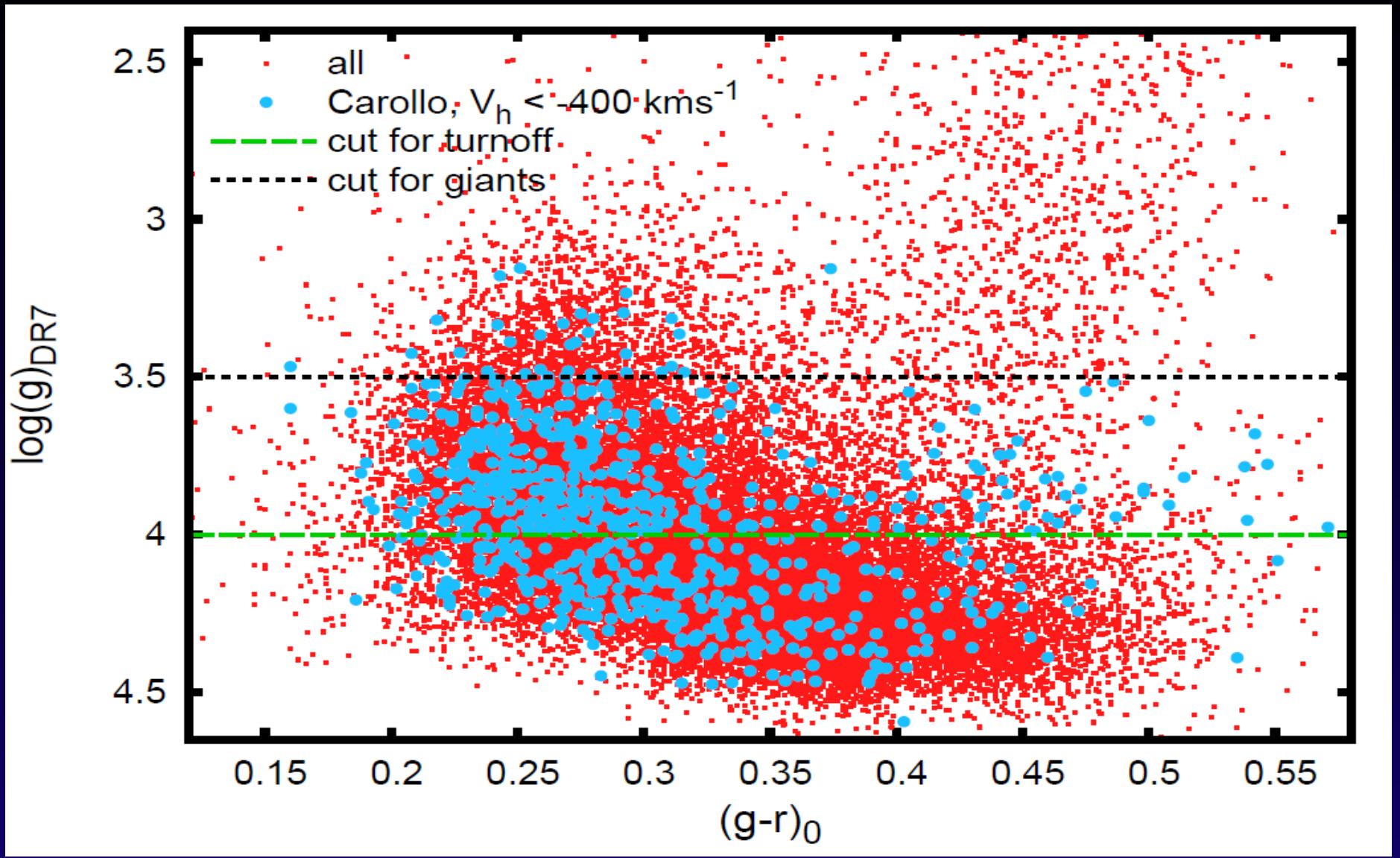


Dead Tree Walking...

SEGUE azimuthal velocities have almost no radial velocity support

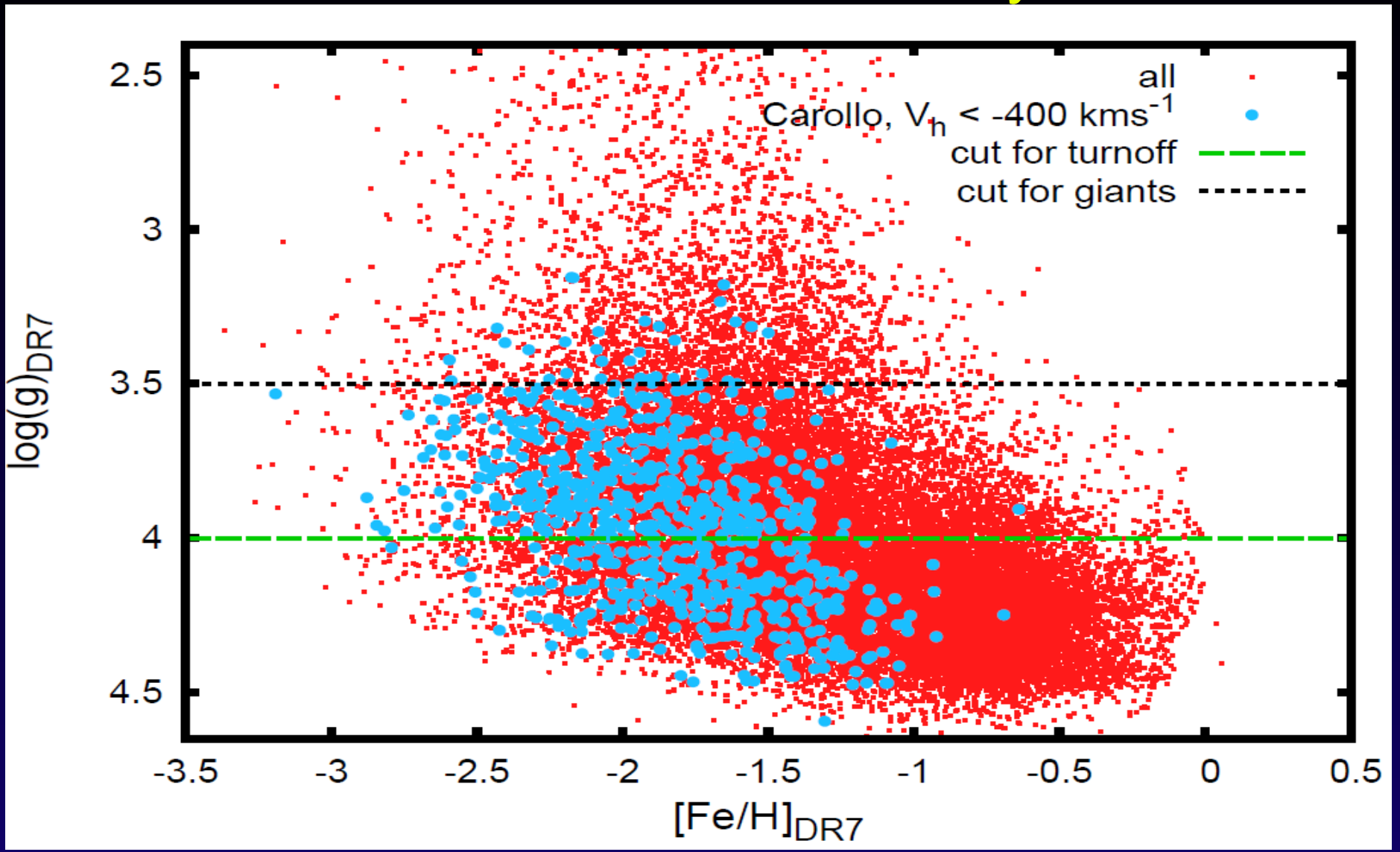


Gravities on colour



-almost no branches apparent - gravities do not allow for a clean cut
-crowding of counterrotating stars in the turnoff region

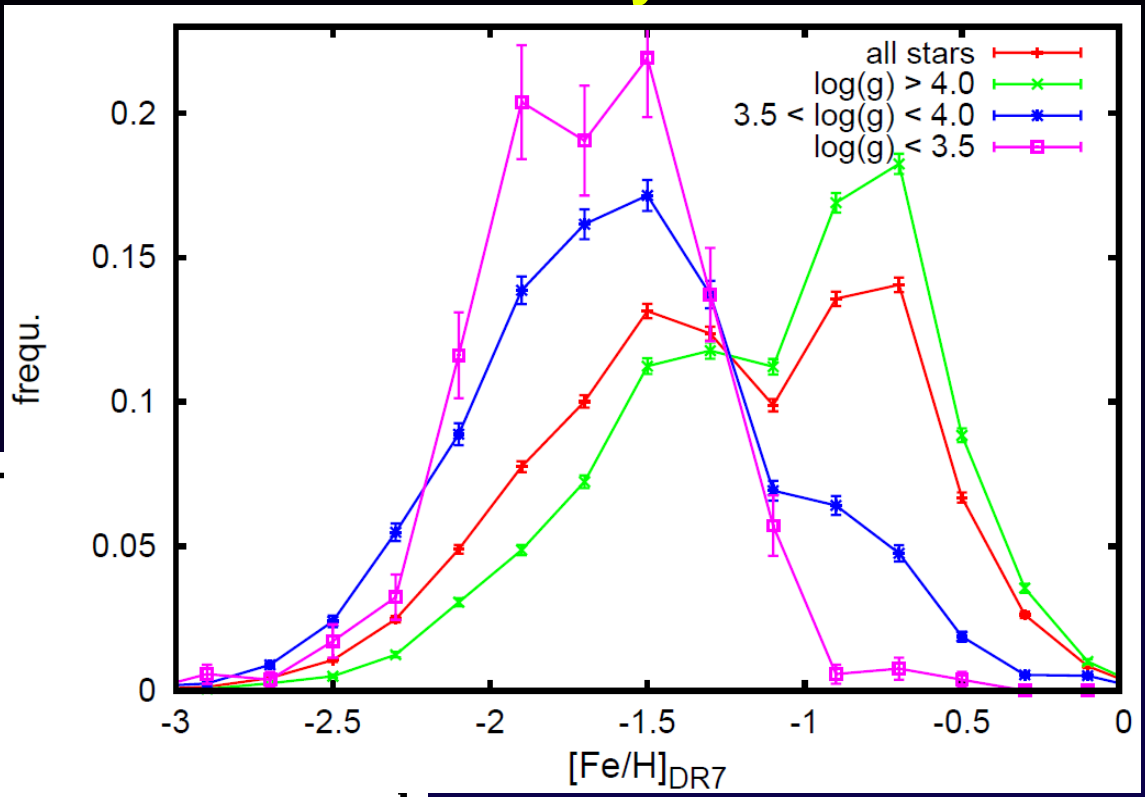
Gravities vs metallicity

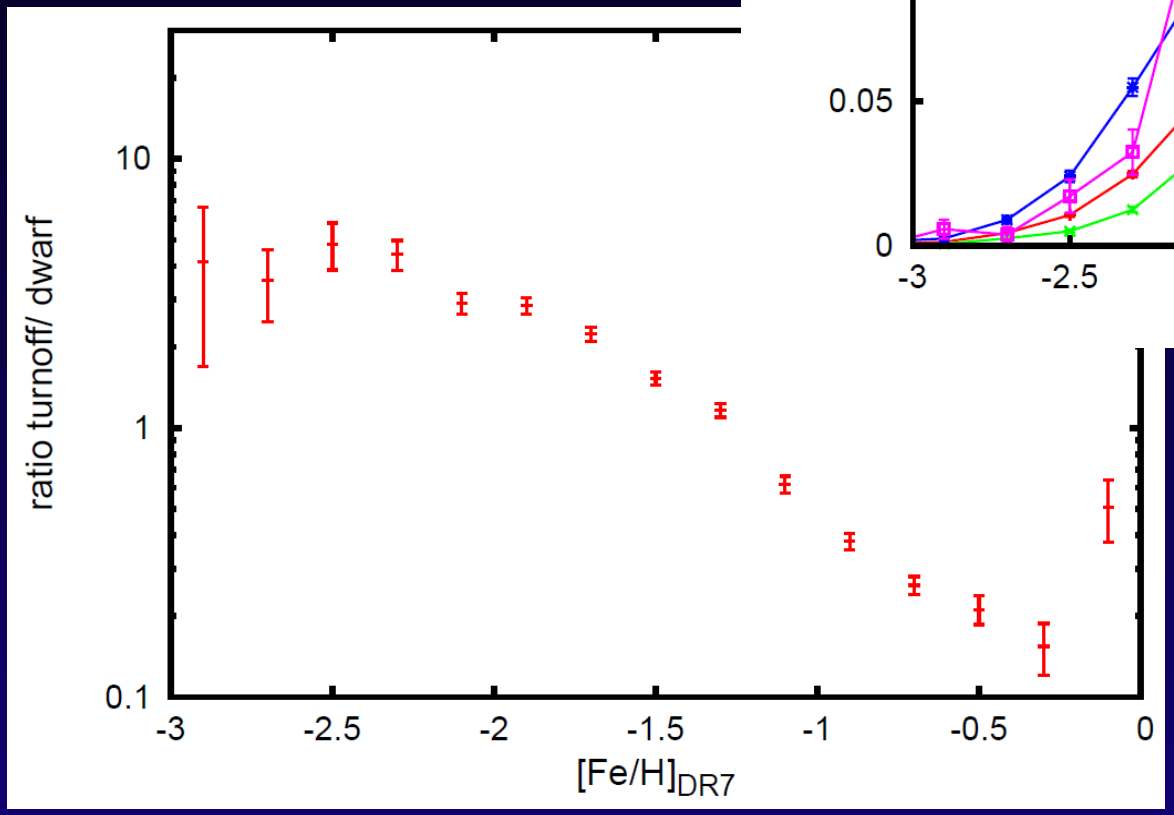


Downslope with metallicity increases relative number of metal poor turnoff stars

Gravities vs metallicity

Low gravity stars
are highly metal poor

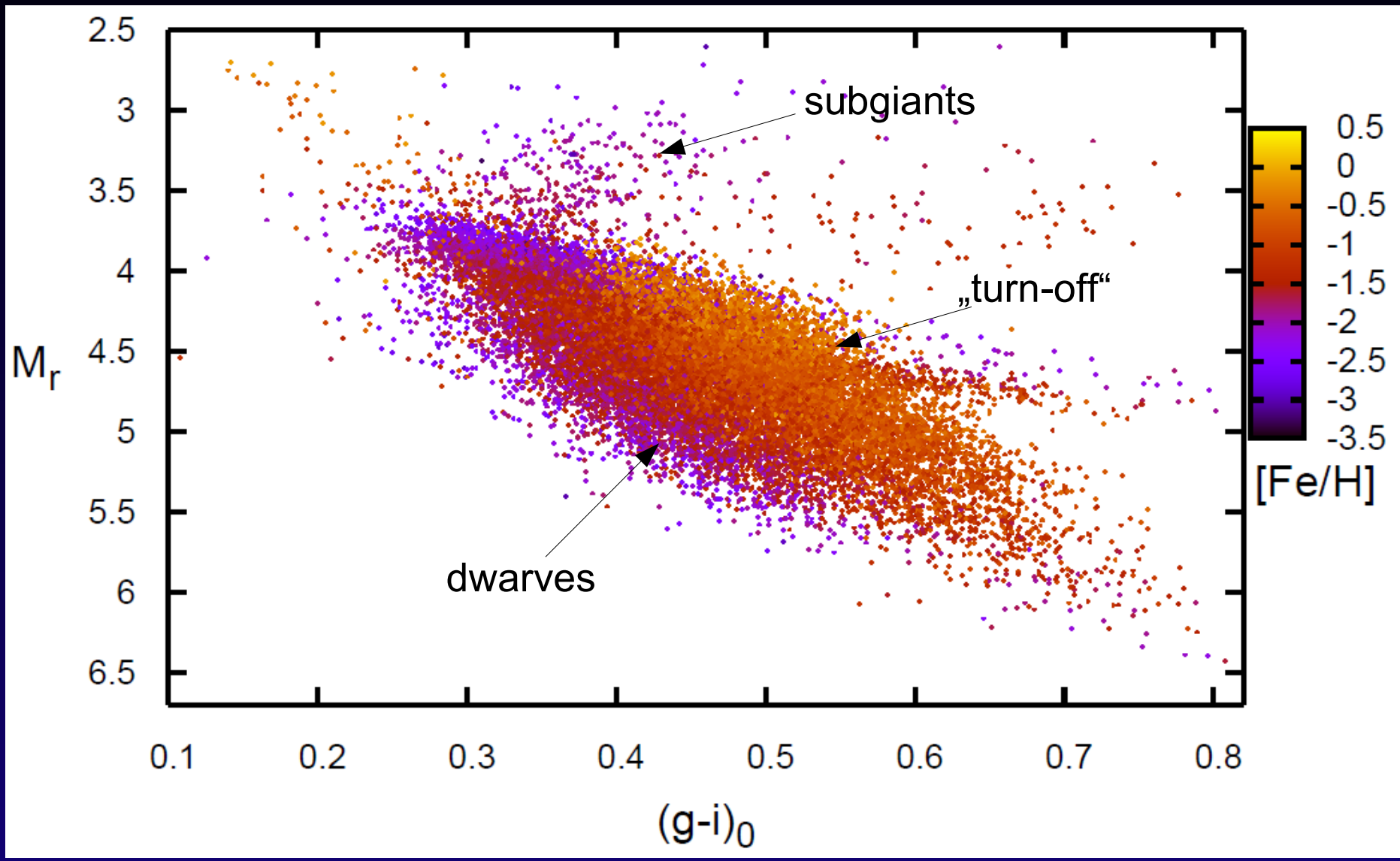




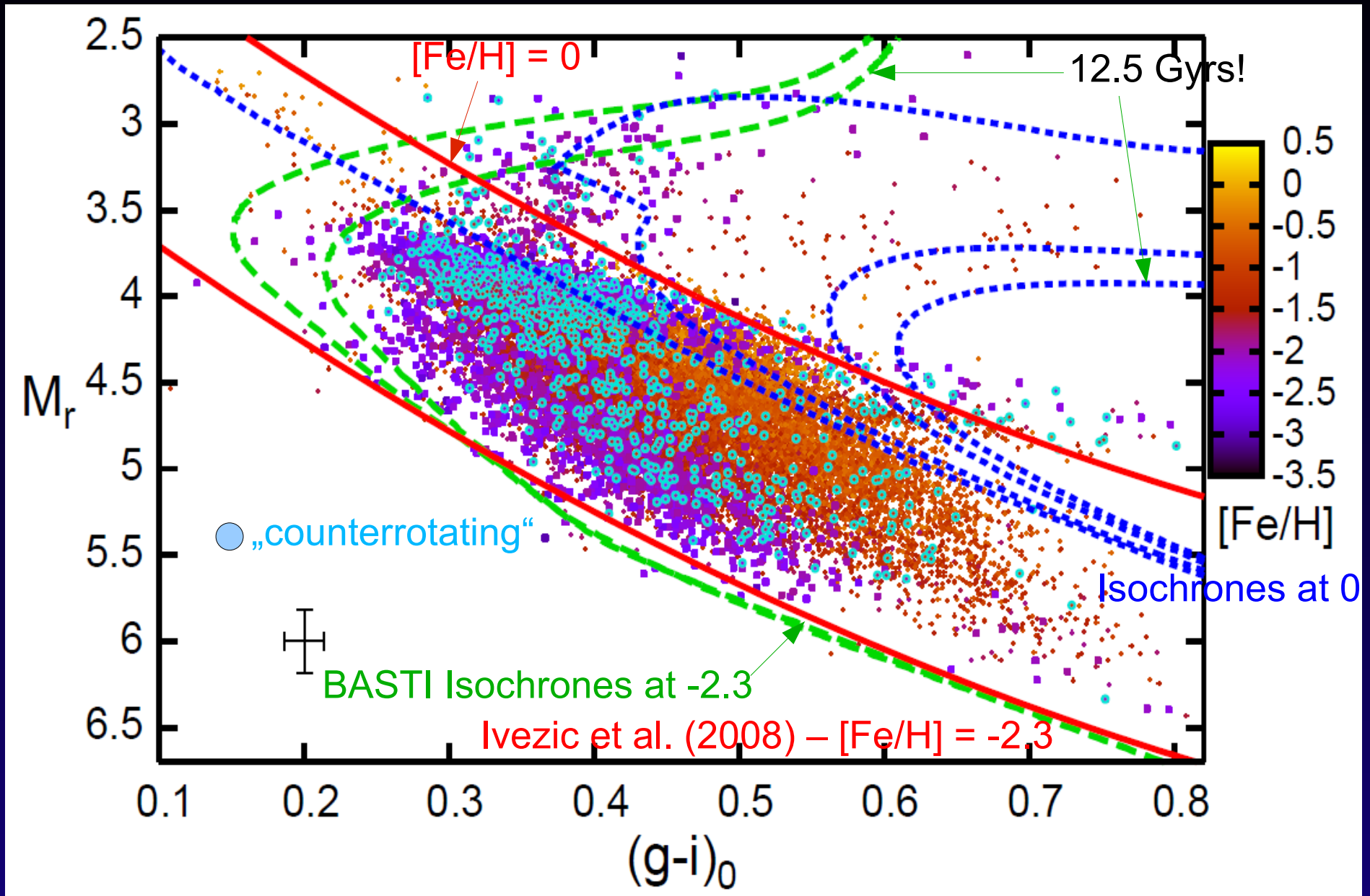
Ratio of thought-to-be
turnoff stars increases
towards metal poor halo

Reconstructed colour-magnitude diagram

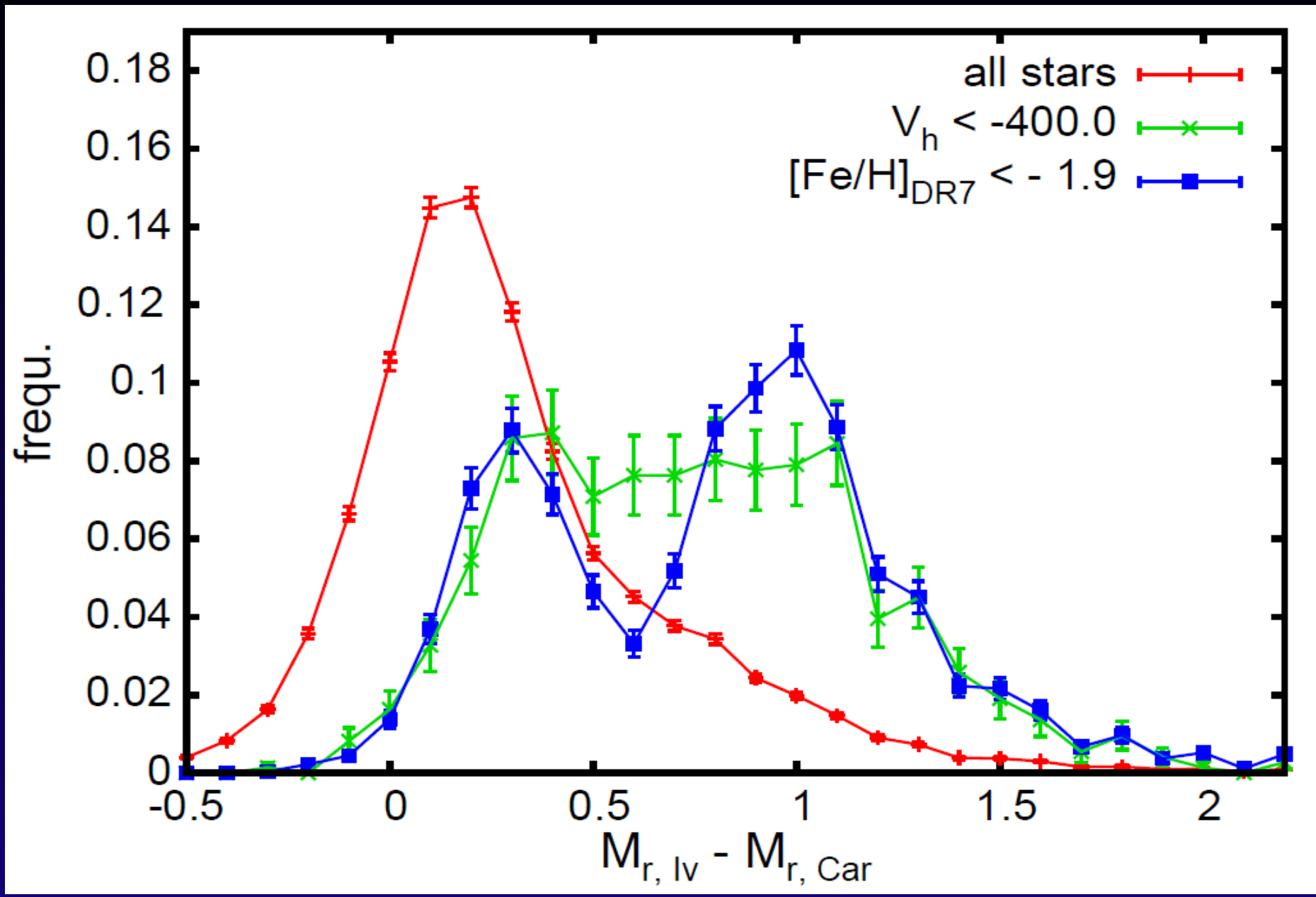
Absolute magnitudes reconstructed from Carollo et al. (2010) distances and pipeline dereddened photometry



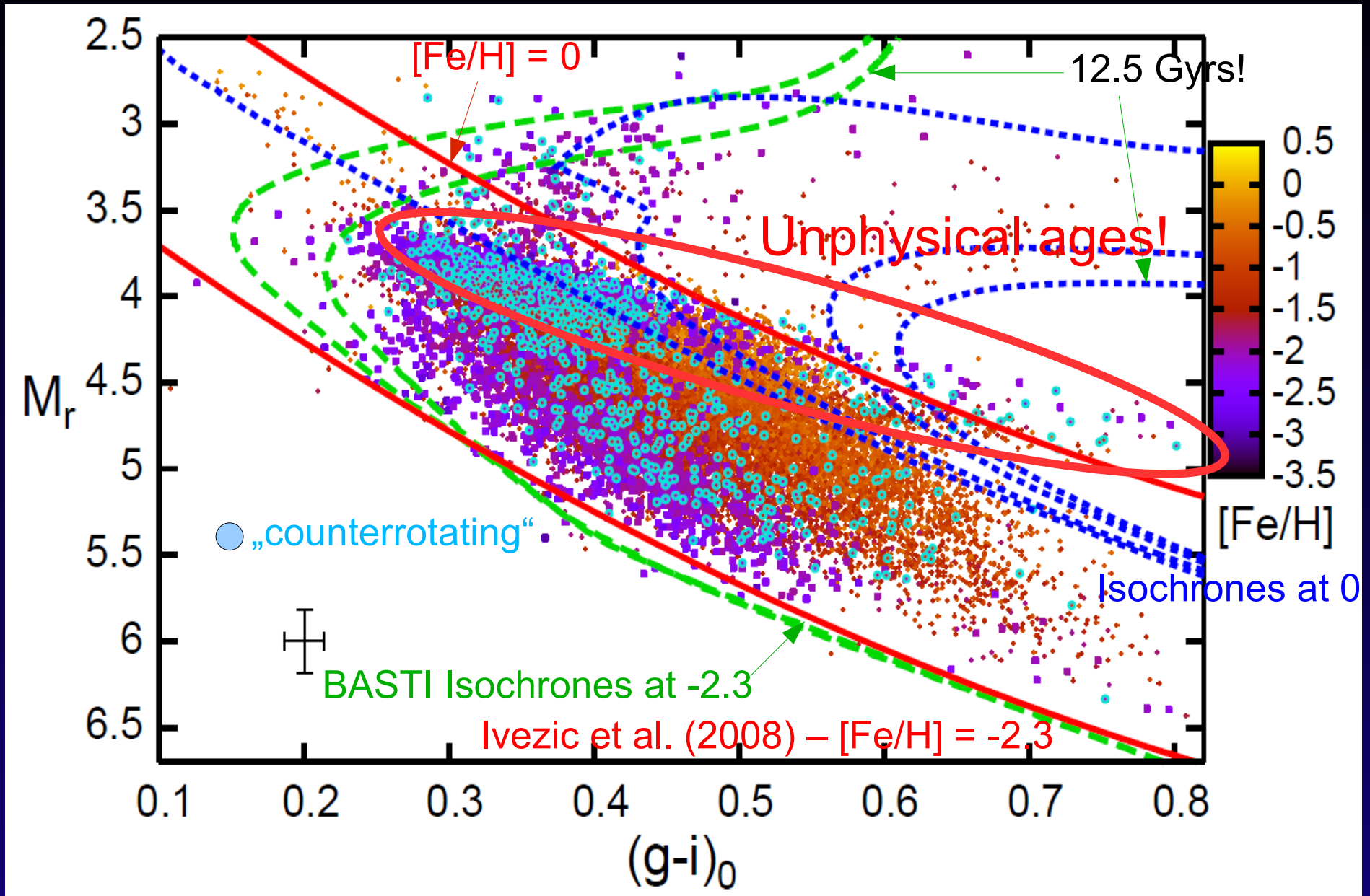
Reconstructed colour-magnitude diagram



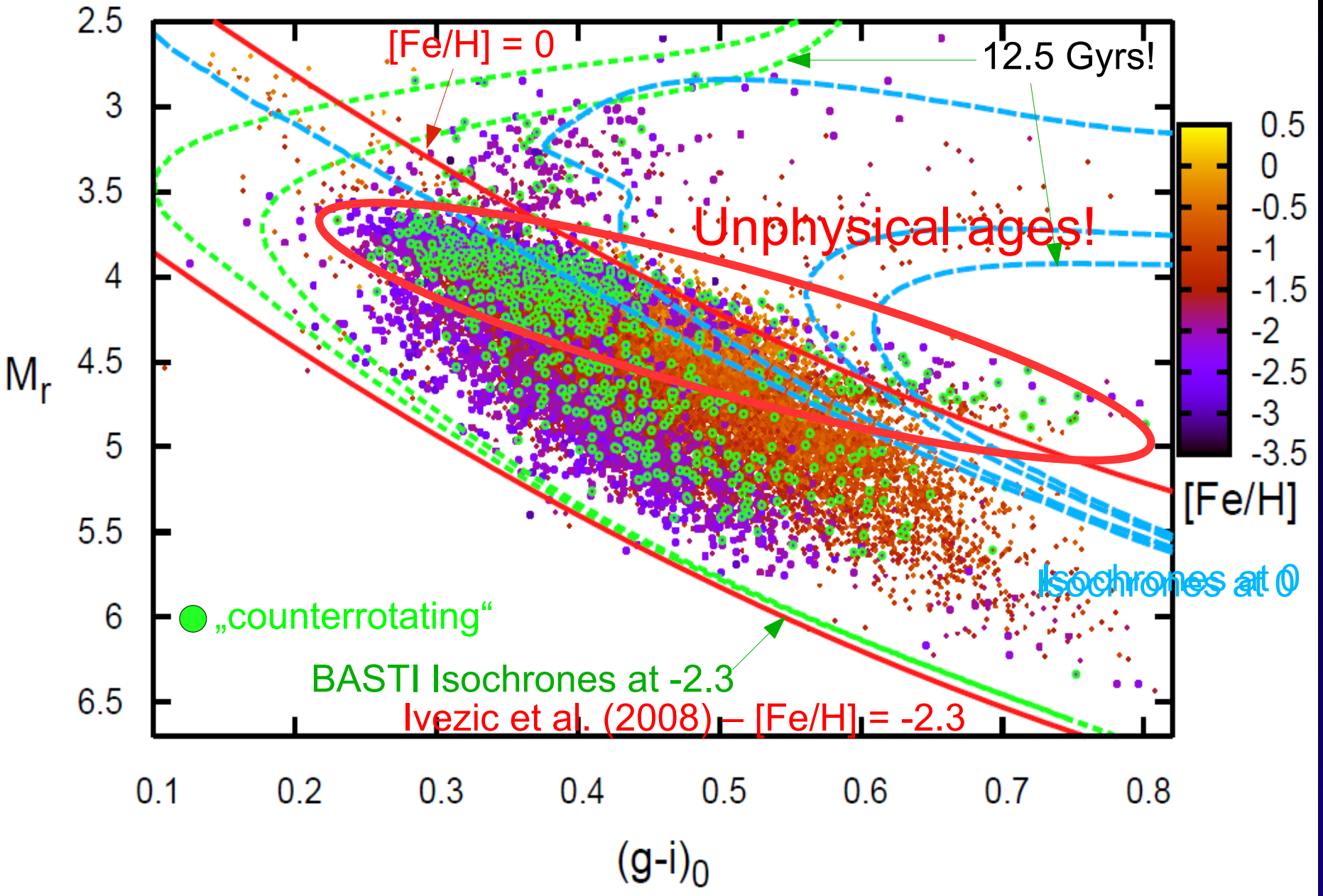
Absolute magnitude difference



Reconstructed colour-magnitude diagram

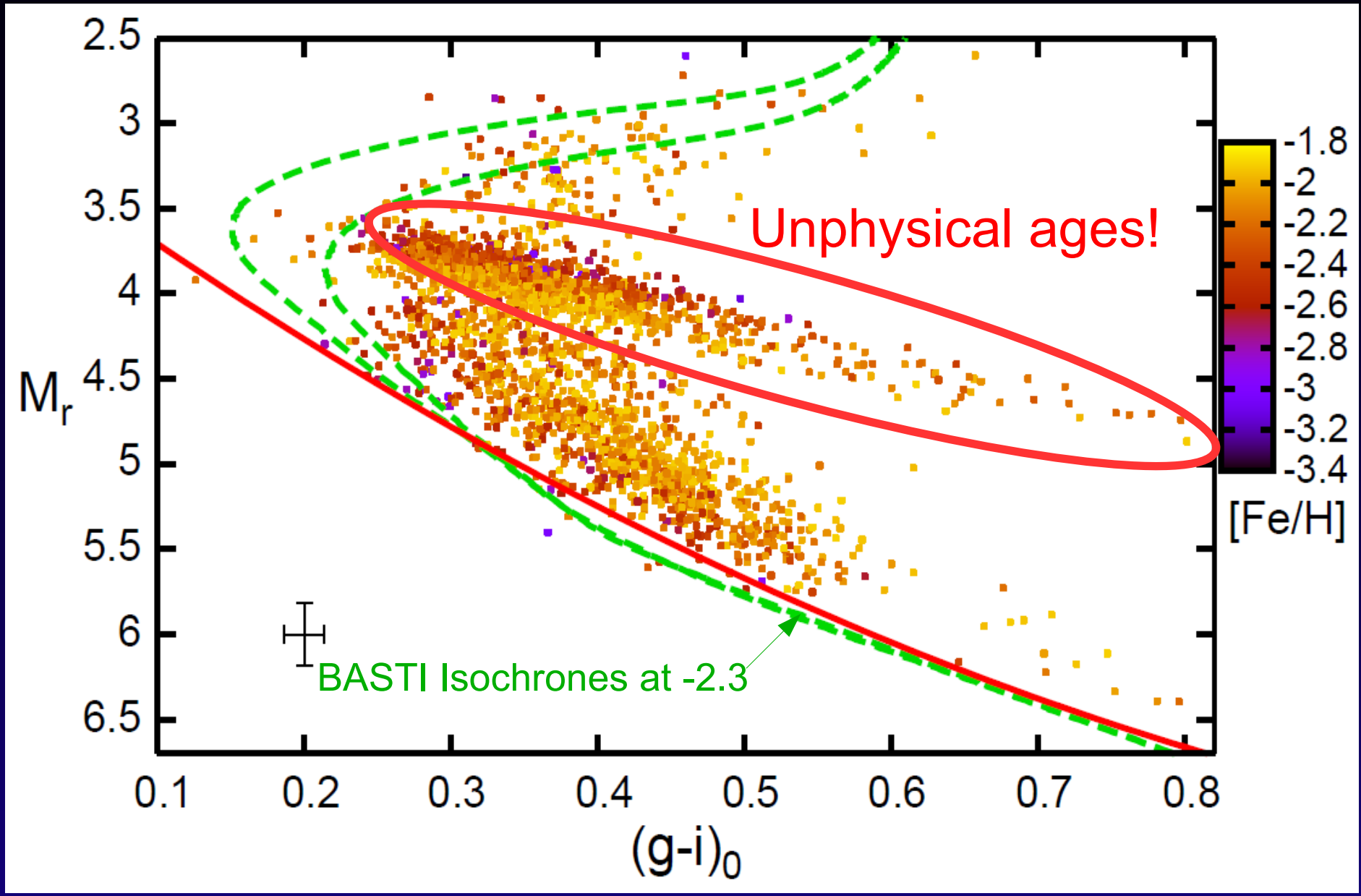


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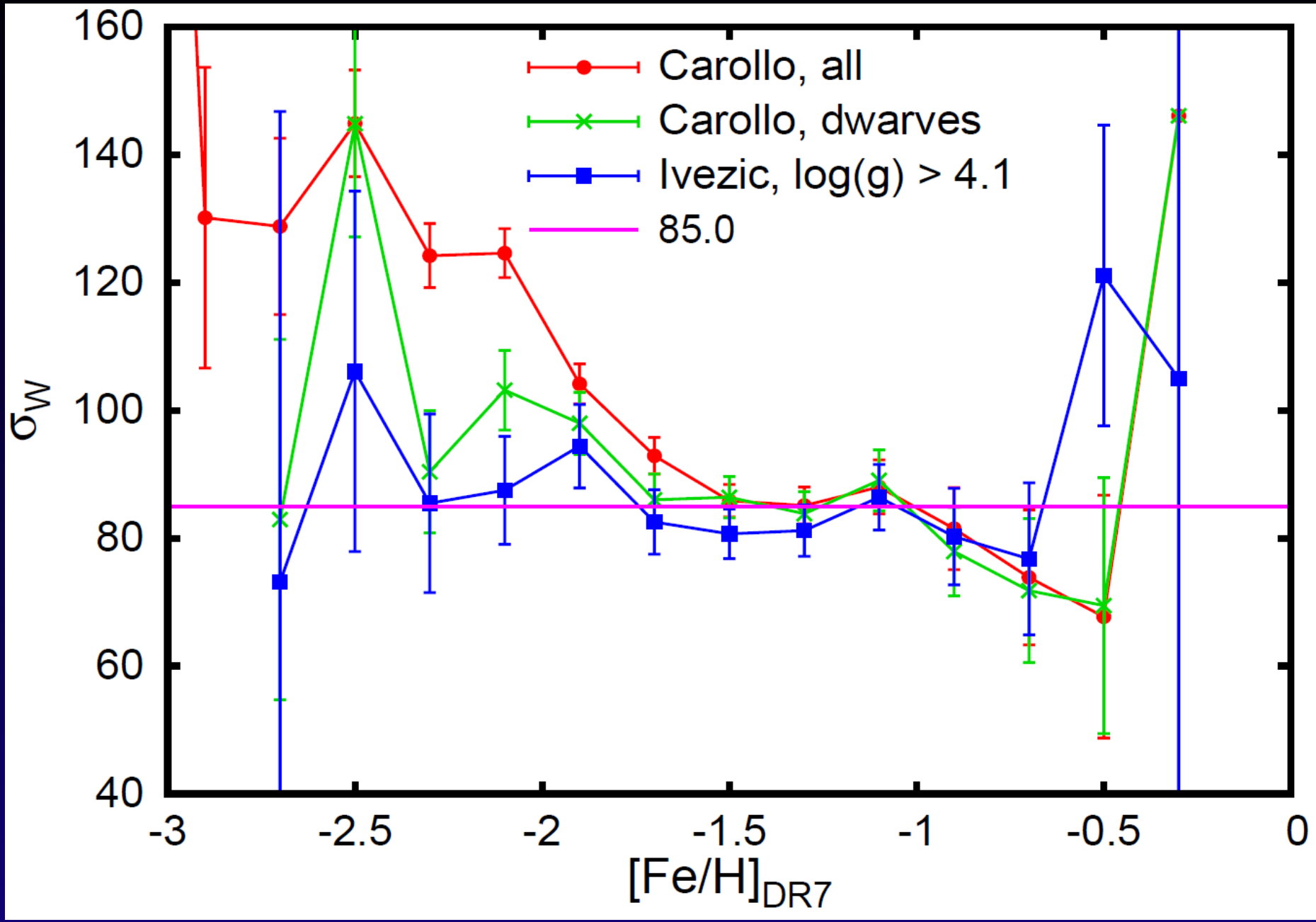


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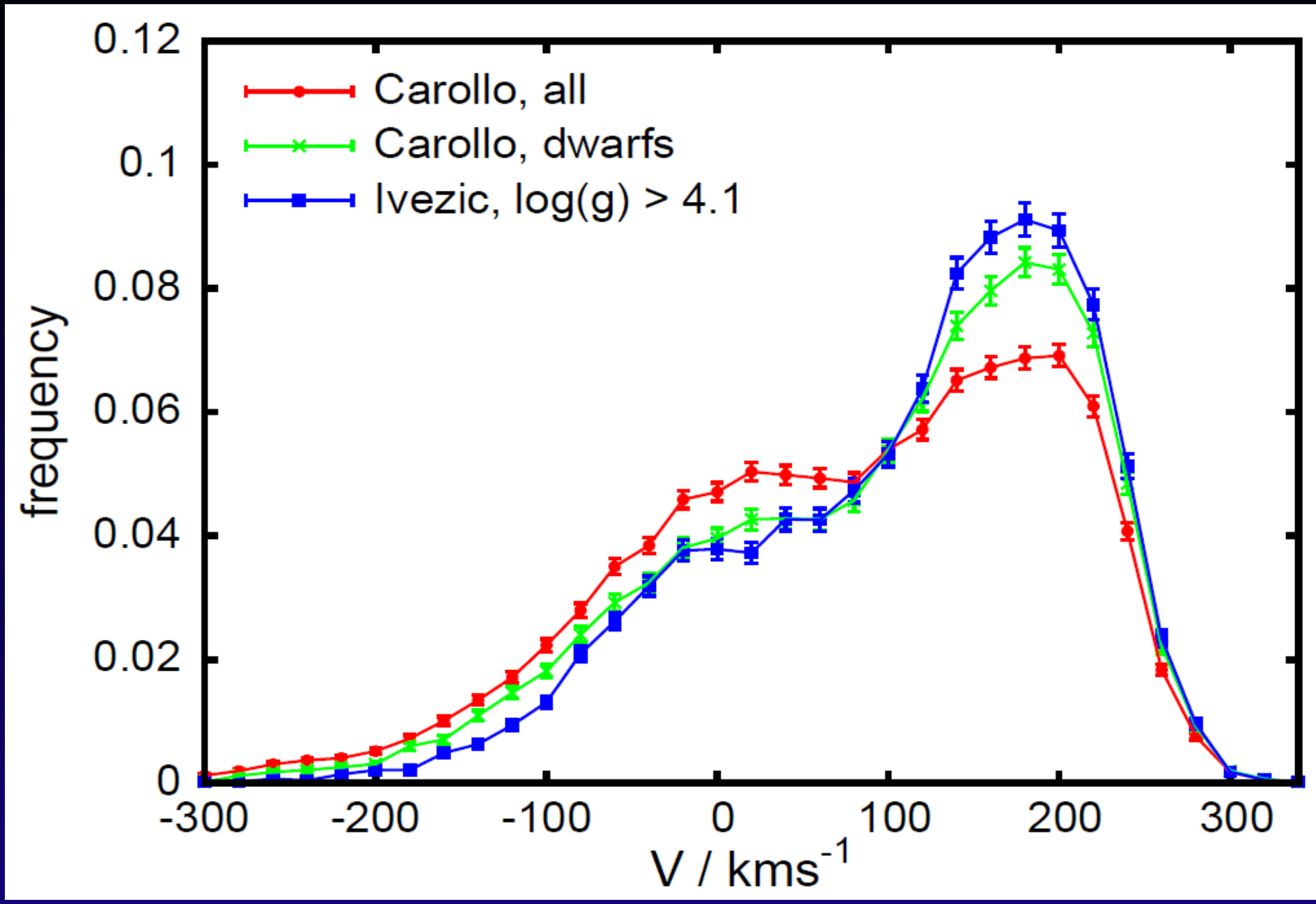
Metal poor stars



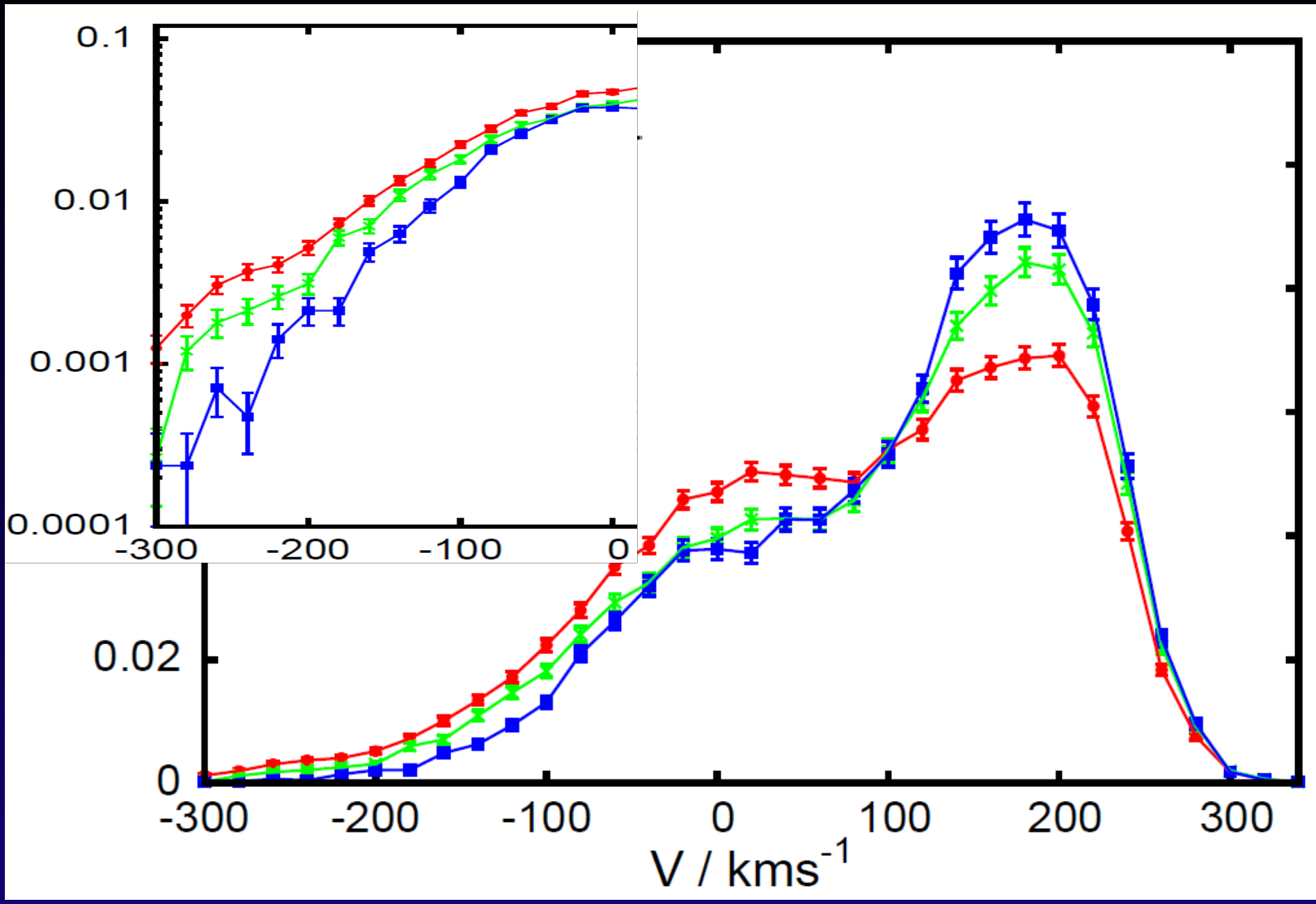
Vertical dispersion vs metallicity



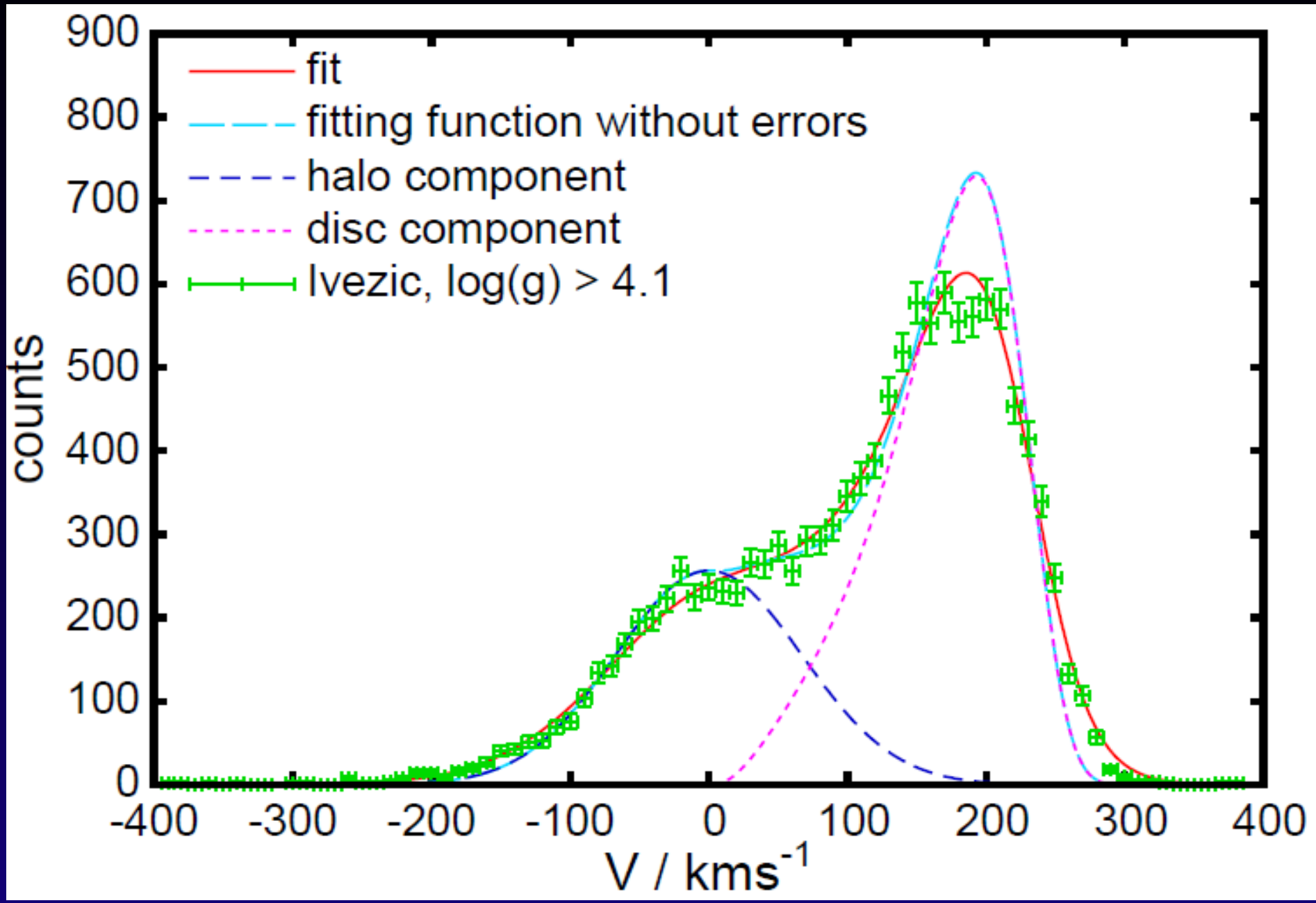
Velocity distributions



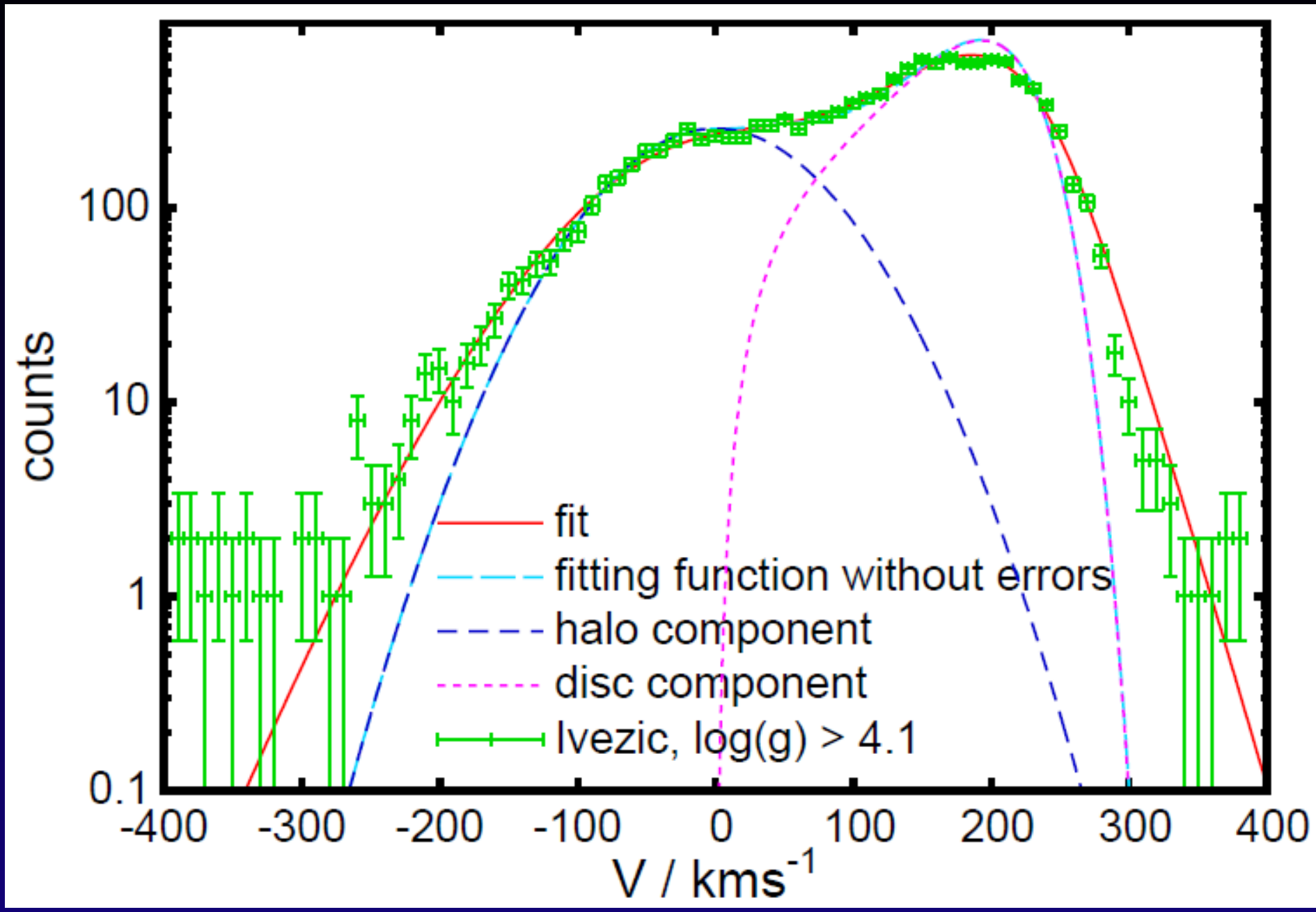
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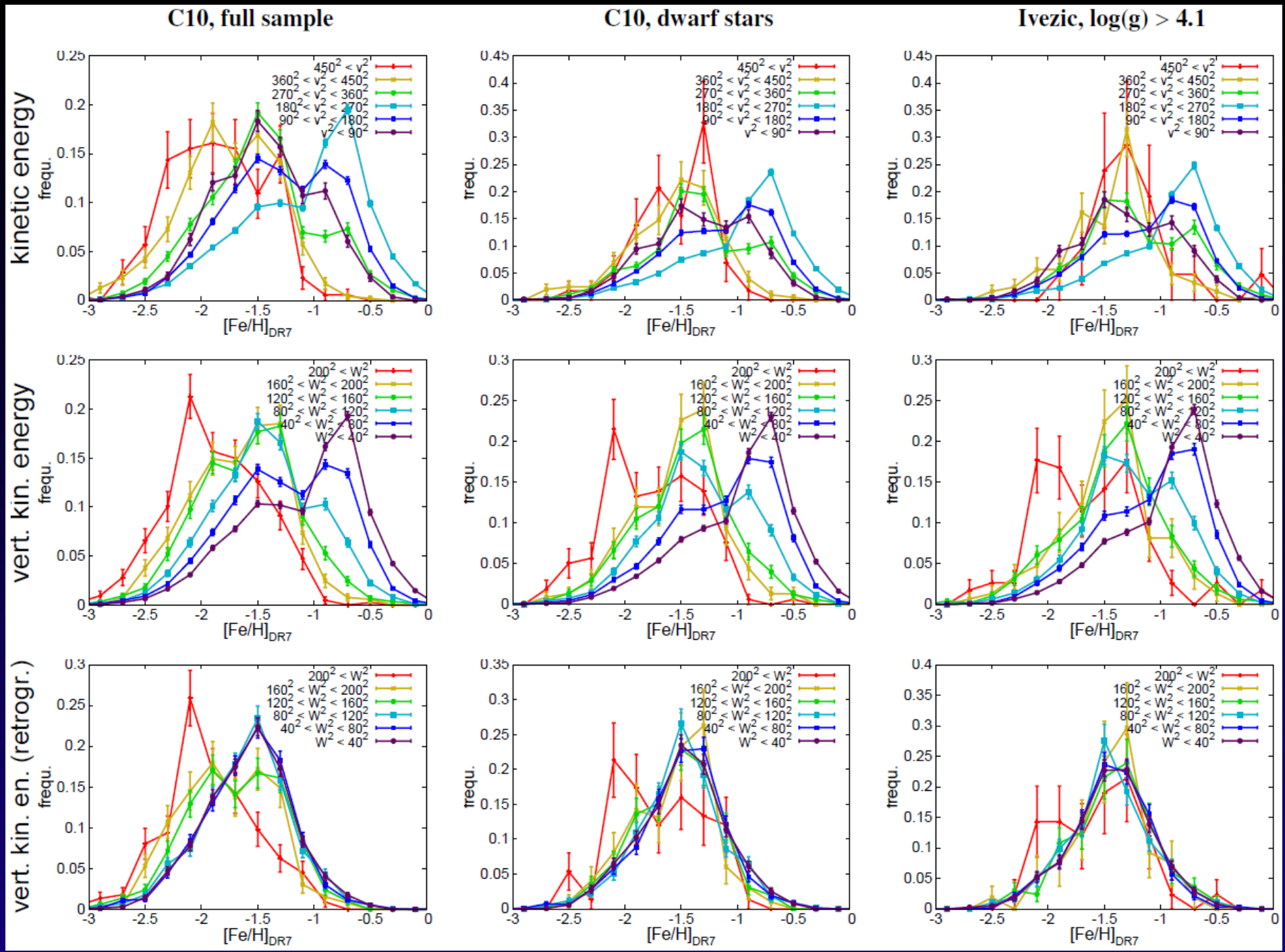


Fitting azimuthal velocities



Fitting azimuthal velocities




C10, full sample
C10, dwarf stars
Ivezic, log(g) > 4.1
kinetic energy
vert. kin. energy
vert. kin. en. (retrogr.)
frequ.
[Fe/H]DR7
450² < v²
360² < v² < 450²
270² < v² < 360²
180² < v² < 270²
90² < v² < 180²
v² < 90²
200² < W²
160² < W² < 200²
120² < W² < 160²
80² < W² < 120²
40² < W² < 80²
W² < 40²

Summary

The Carollo et al. outer halo is a consequence of distance errors (up to 50% in the tail) and use of Gaussian analysis (cf. Strömberg 1927)

- sorting stars into unphysical positions in CMD
- magnitude uncertainties in the turn-off region
- very bright main sequence calibration
- problems with gravities at lowest metallicities
- colour transformation

We cannot find any reliable distinct outer halo component

The azimuthal V distribution can be fit by single disc + halo

A slight excess of high vertical motion stars coincides with a stream found by Helmi et al. (1999)