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ESO

Science with MAD MAX:

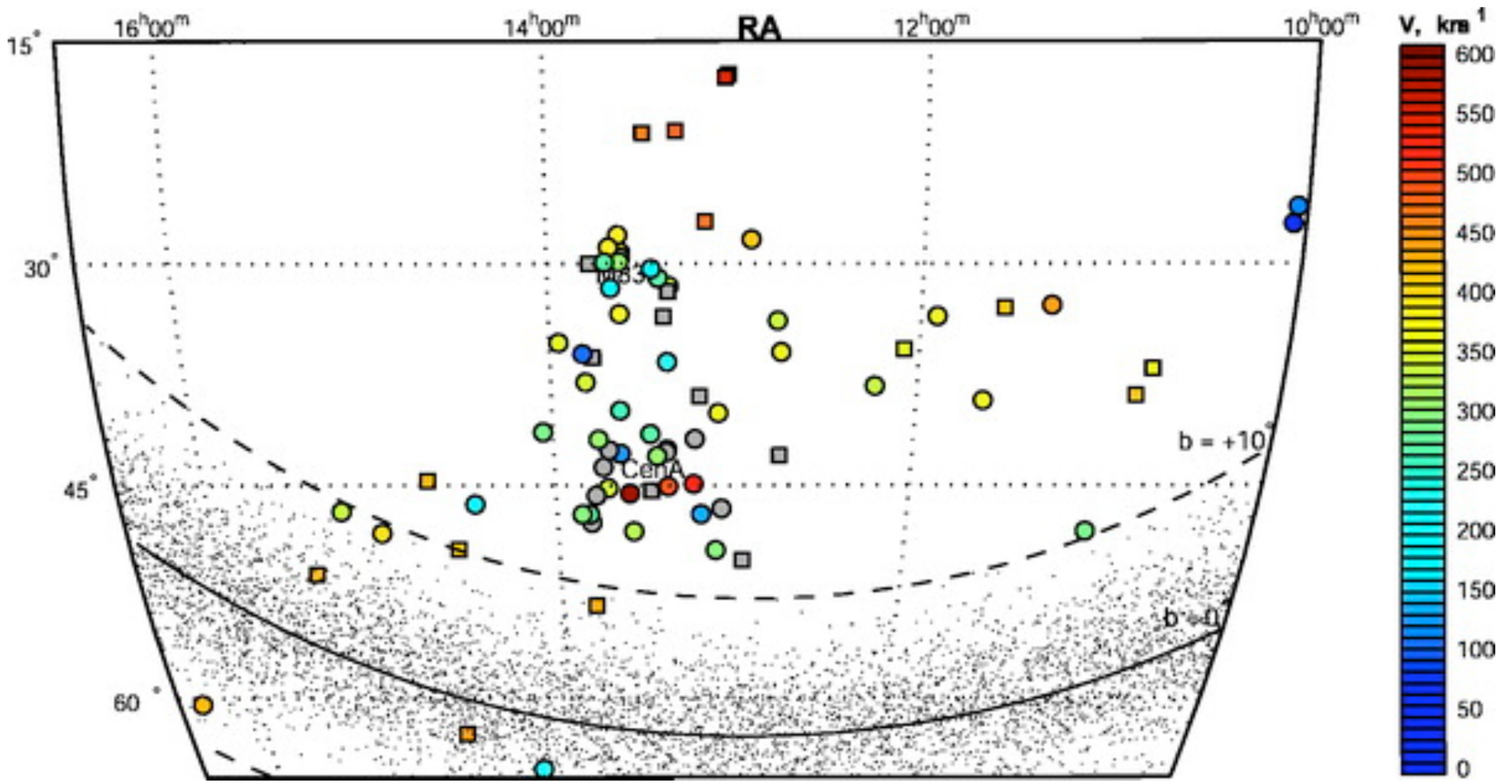
Dwarf Galaxies in the Centaurus A group

Scientific Rationale

Centaurus Group:

- A high-density group of ~40 galaxies dominated by the giant E/S0 active galaxy NGC 5128 (CenA) and the starburst M83
- distance: 3.6Mpc => $(m\text{-}M)_0 \sim 27.8$
- Most of them have HST optical imaging

Karachentsev+2007



Scientific Rationale

Motivations

- Obtain an estimate of the SFR for the intermediate-age stellar population
- Correlate the SFHs with the environment
- Compare with the properties of Local Group dEs
- Understand what processes govern star formation in low-mass systems

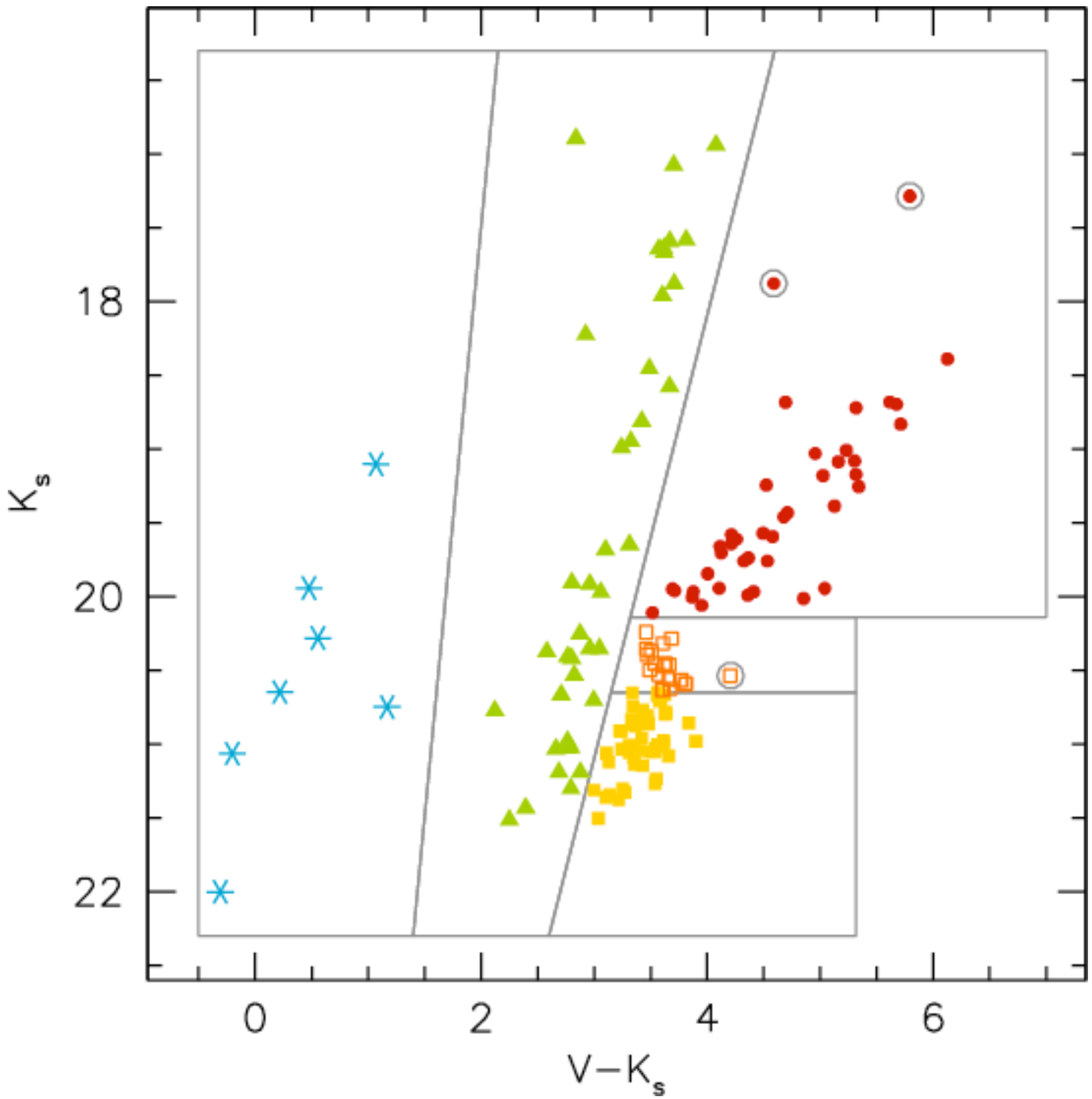
Starting point: MAD observations

MAD (+HST)

results on UKS 2323-236

- $(m\text{-}M)_0$=26.74 (2.23 Mpc)
- SCAO + layer oriented
- J and K : 30 min exptime
- FWHM: 0.011 arcsec
- observations during SD1
- we reached mag>21 in Ks

Gullieuszik+2008



Starting point: MAD observations

LETTER TO THE EDITOR

Resolving stellar populations outside the Local Group: MAD observations of UKS 2323-326⋆

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ABSTRACT

Aims. We present a study aimed at deriving constraints on star formation at intermediate ages from the evolved stellar populations in the dwarf irregular galaxy UKS 2323-326. These observations were also intended to demonstrate the scientific capabilities of the multi-conjugated adaptive optics demonstrator (MAD) implemented at the ESO Very Large Telescope as a test-bench of adaptive optics (AO) techniques.
Methods. We perform accurate, deep photometry of the field using J and K_s band AO images of the central region of the galaxy.
Results. The near-infrared (IR) colour-magnitude diagrams clearly show the sequences of asymptotic giant branch (AGB) stars, red supergiants, and red giant branch (RGB) stars down to ~1 mag below the RGB tip. Optical-near-IR diagrams, obtained by combining our data with Hubble Space Telescope observations, provide the best separation of stars in the various evolutionary stages. The counts of AGB stars brighter than the RGB tip allow us to estimate the star formation at intermediate ages. Assuming a Salpeter initial mass function, we find that the star formation episode at intermediate ages produced $\sim 6 \times 10^5\ M_\odot$ of stars in the observed region.

Starting point: ISAAC observations of CenA dEs

CenA

- 14 dEs in CenA group observed with ISAAC@VLT
- Exp time= J:35m; K: 1h20m
- good seeing conditions (<0.6arsec)

Rejkuba+2006

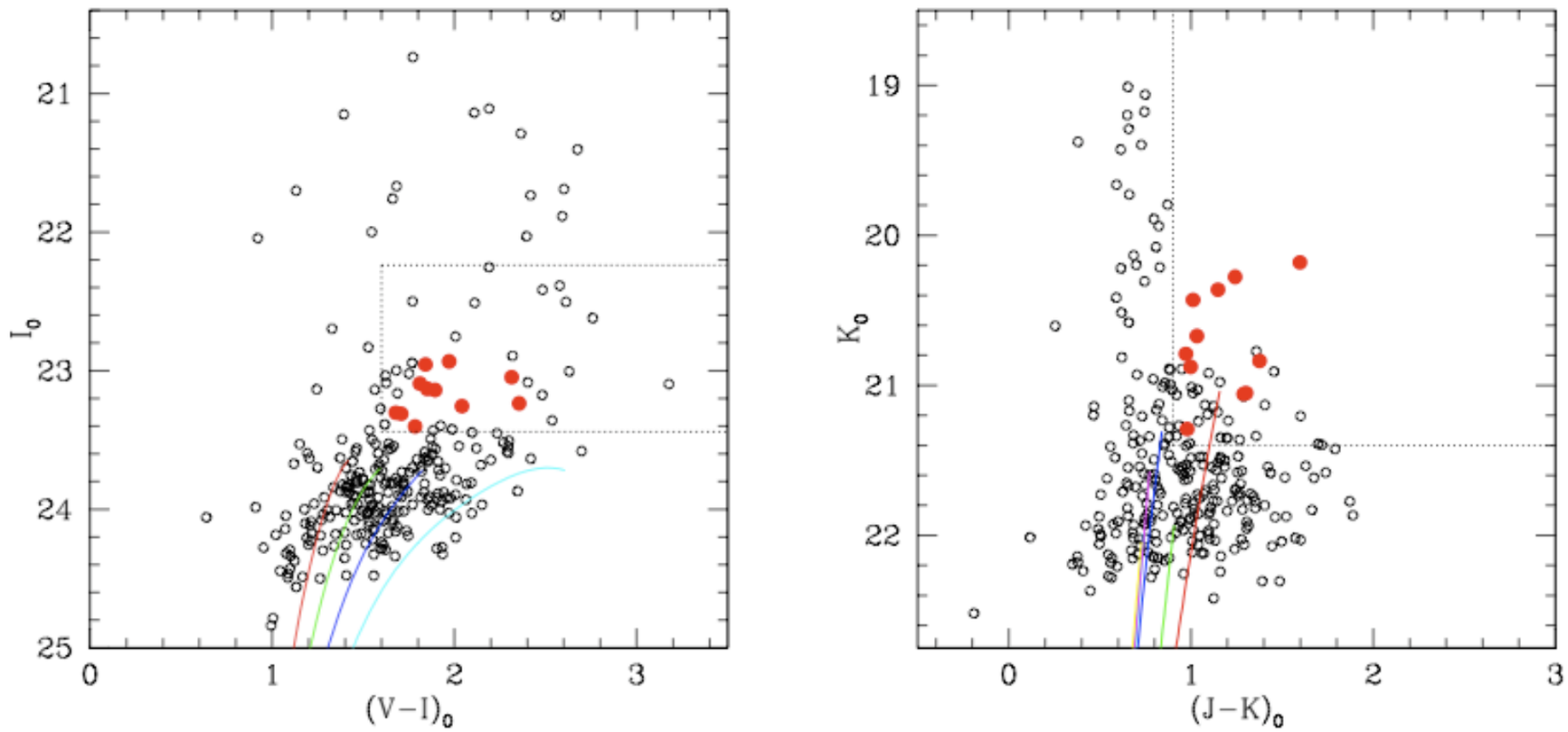
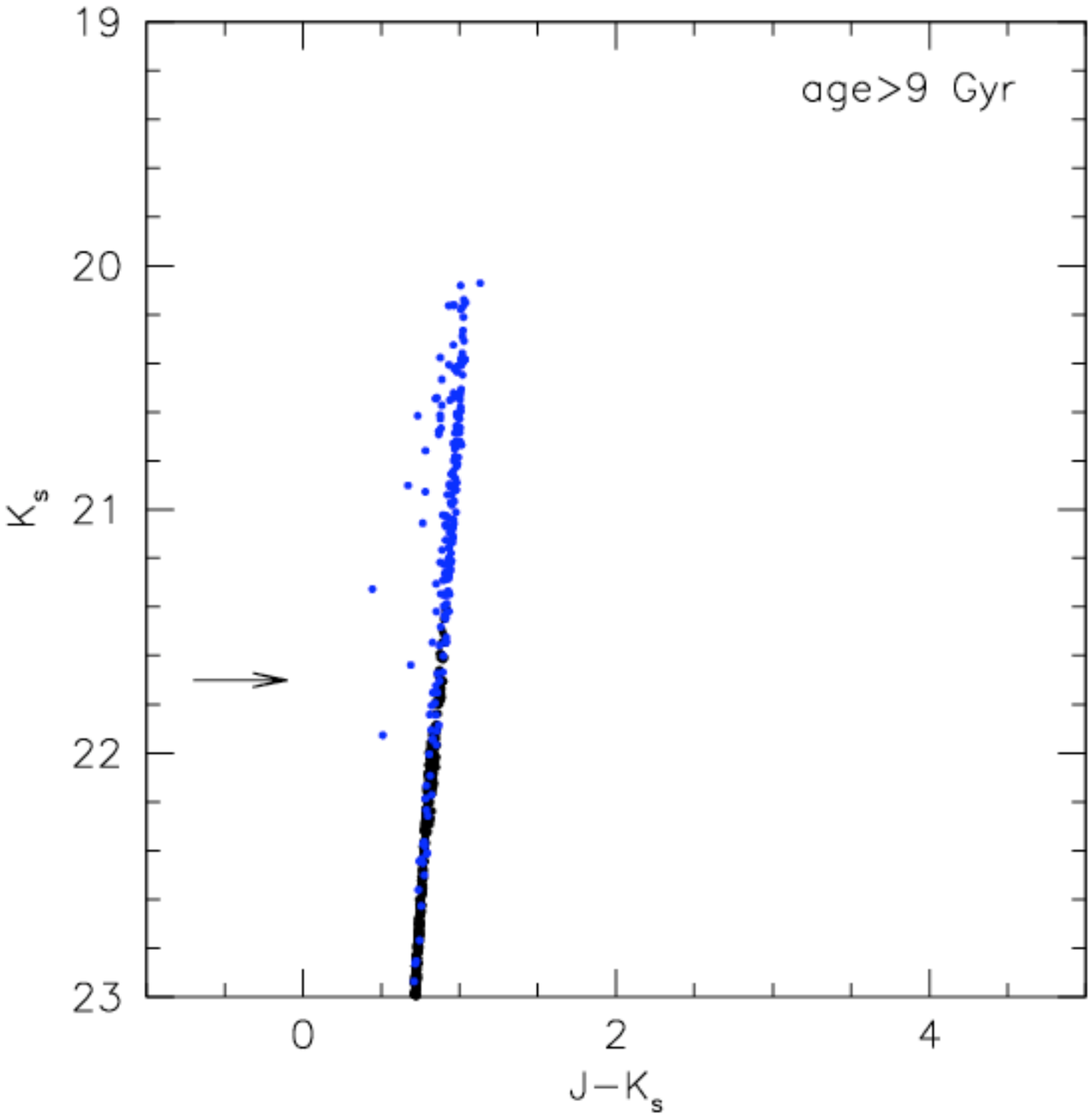


Figure 1. *VI* and *JK* CMDs of AM 1339–445 with overplotted fiducial red giant branches of Galactic globular clusters ranging in metallicity from [Fe/H] = −2.17 (M15) to −0.7 dex (47 Tuc). *Dotted lines* indicate the selection box within which the candidate upper-AGB stars (*larger dots*) are located.

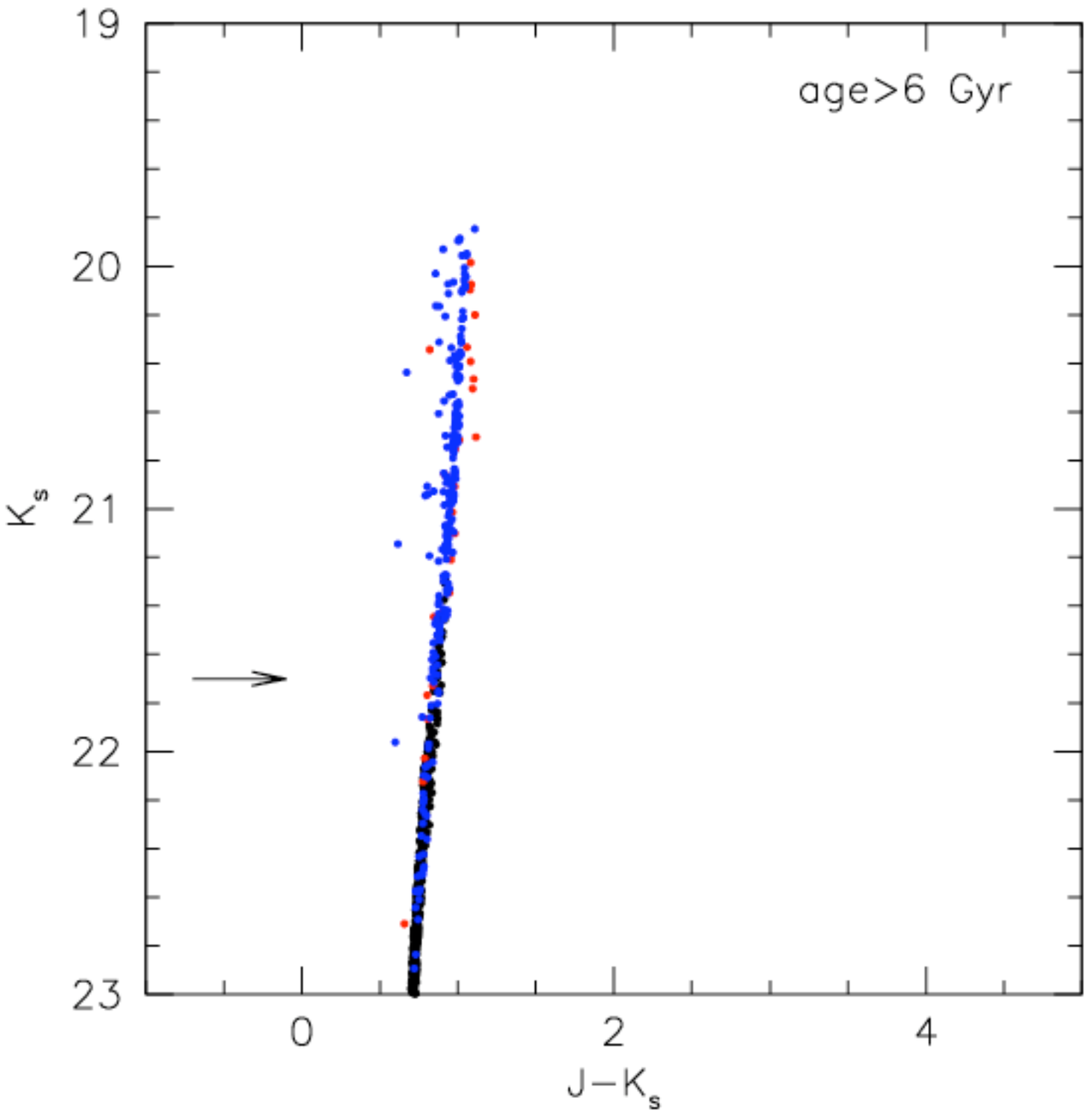
Simulations



TRILEGAL (Girardi+2005) + Marigo et al (2008) isochrones

- 10^7 M_{SUN}
- Constant SFH 9<t<13 Gyrs

Simulations



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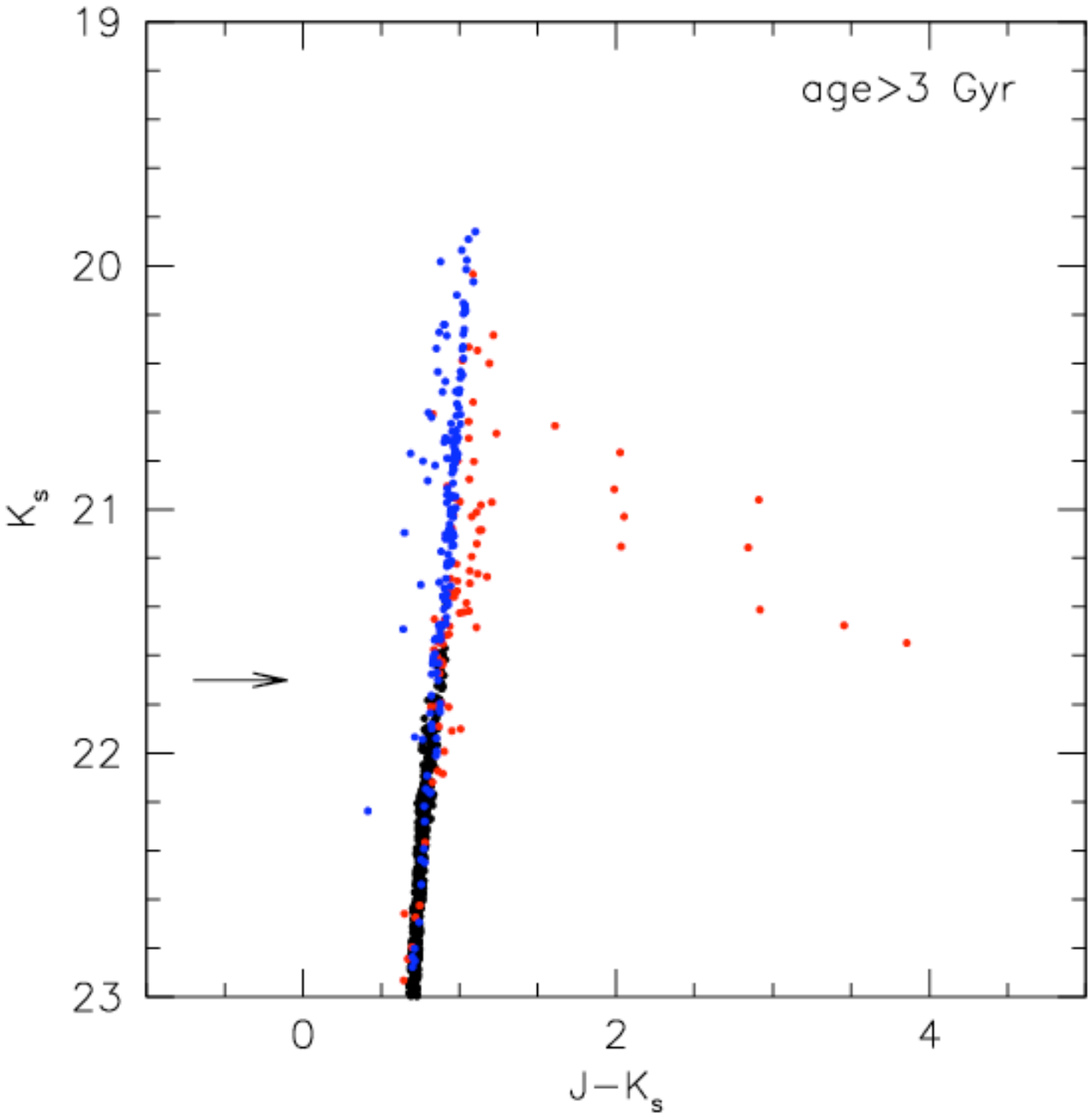

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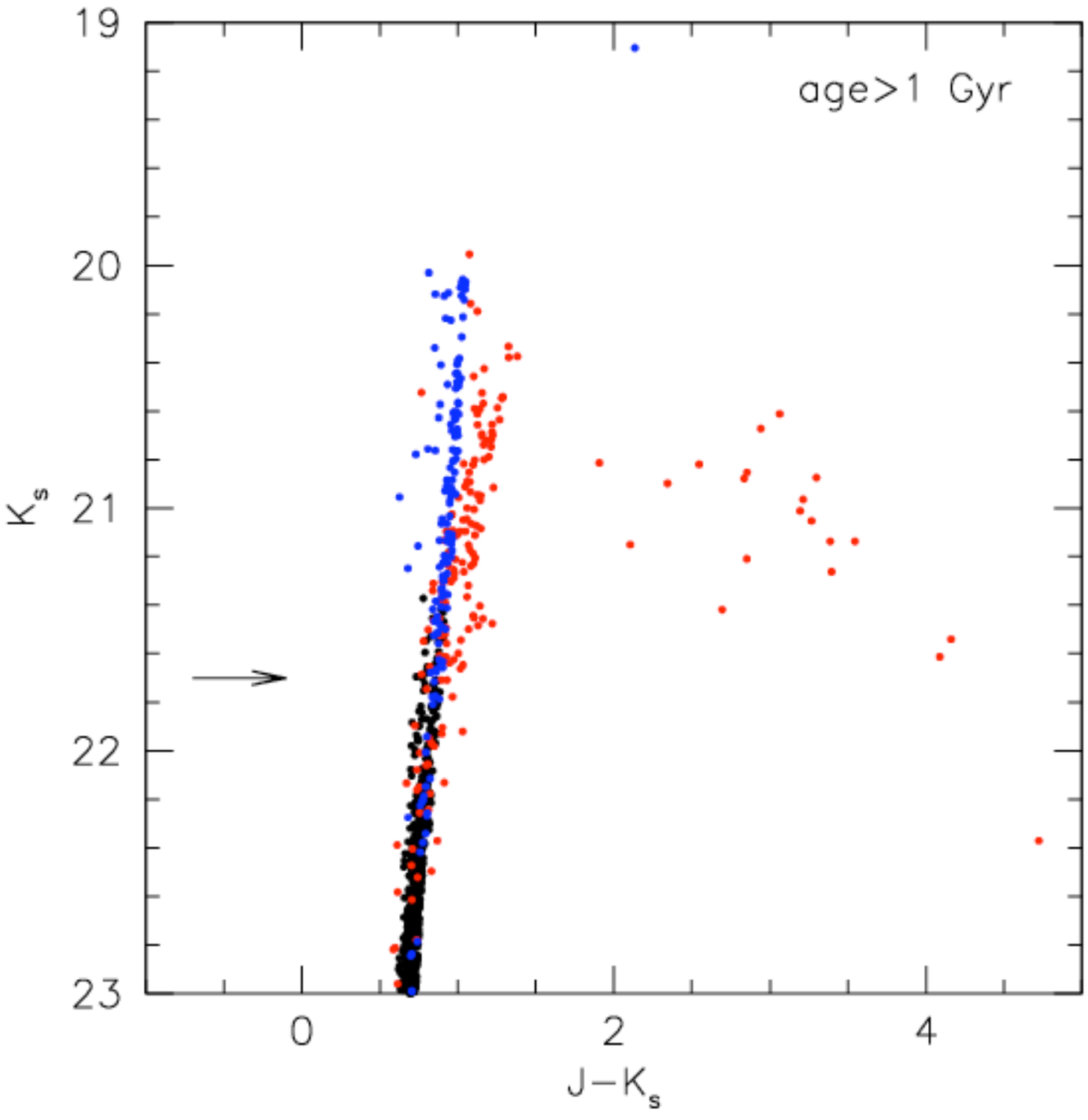

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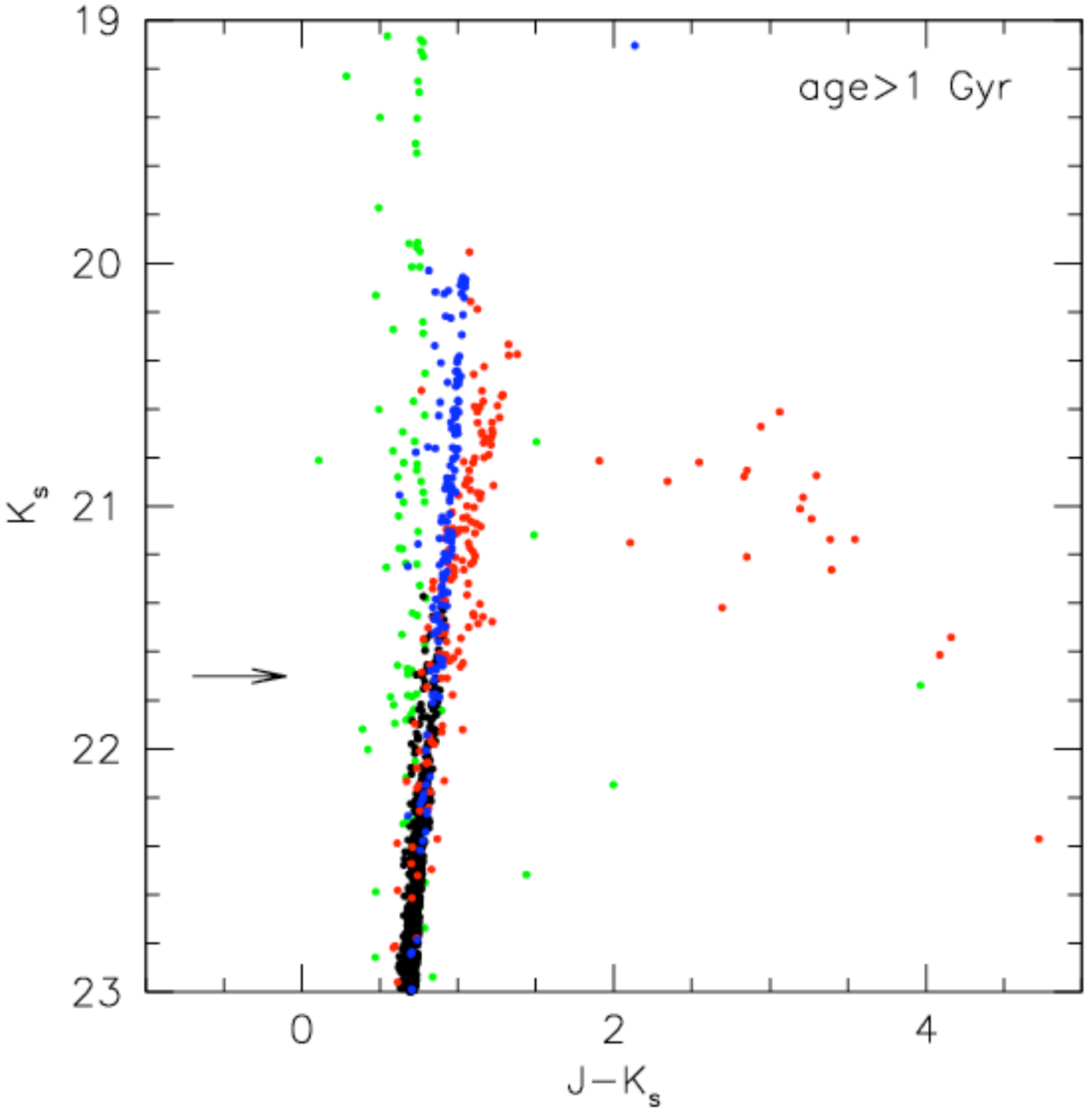


TRILEGAL (Girardi+2005) + Marigo et al (2008) isochrones

- 10^7 M_{SUN}
- Constant SFH 1<t<13 Gyrs

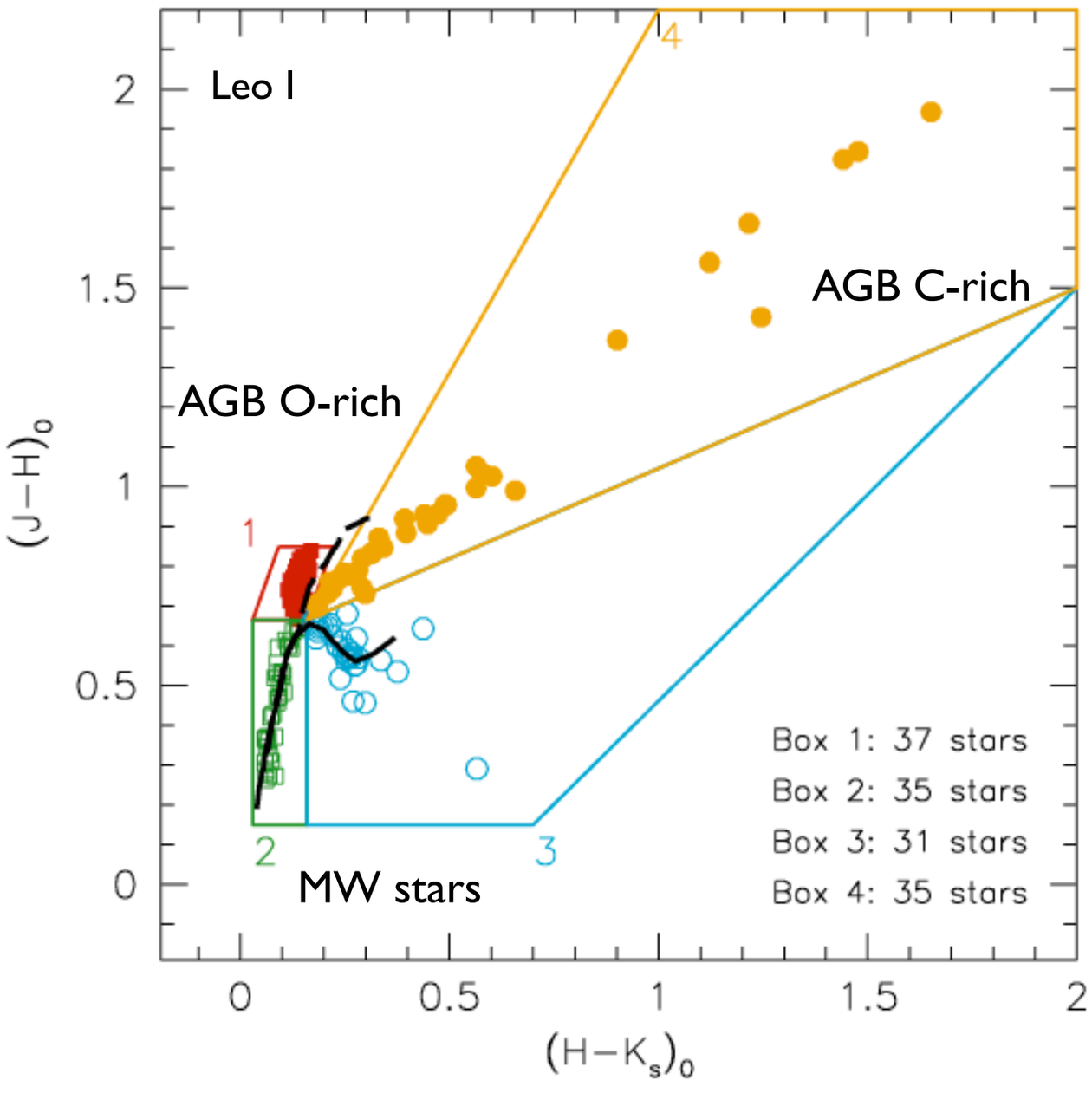
+

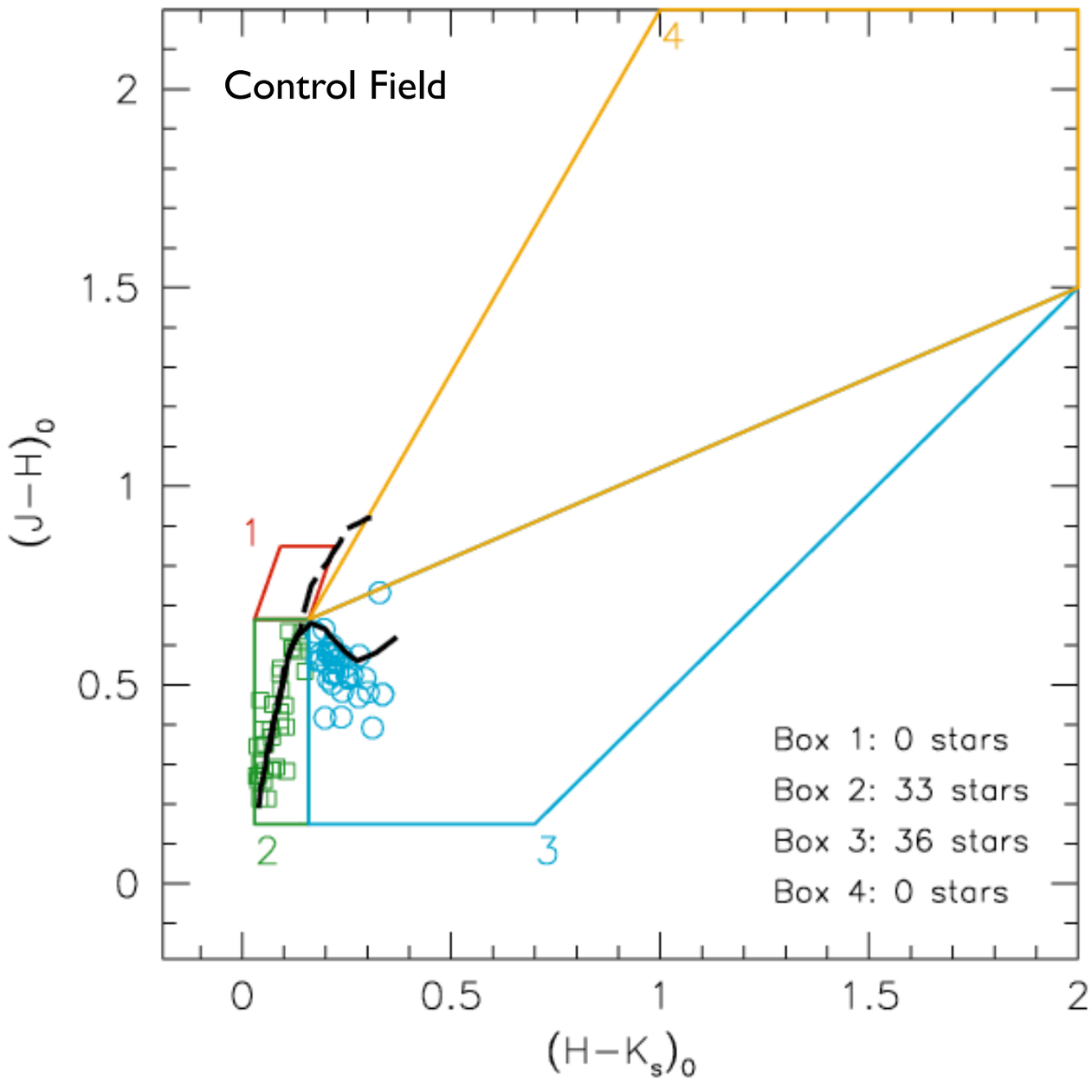
2x2 arcmin^2 Milky Way

Removing the MW foreground

Milky Way dwarfs + Leo I giants + Bessel & Brett (1988) models

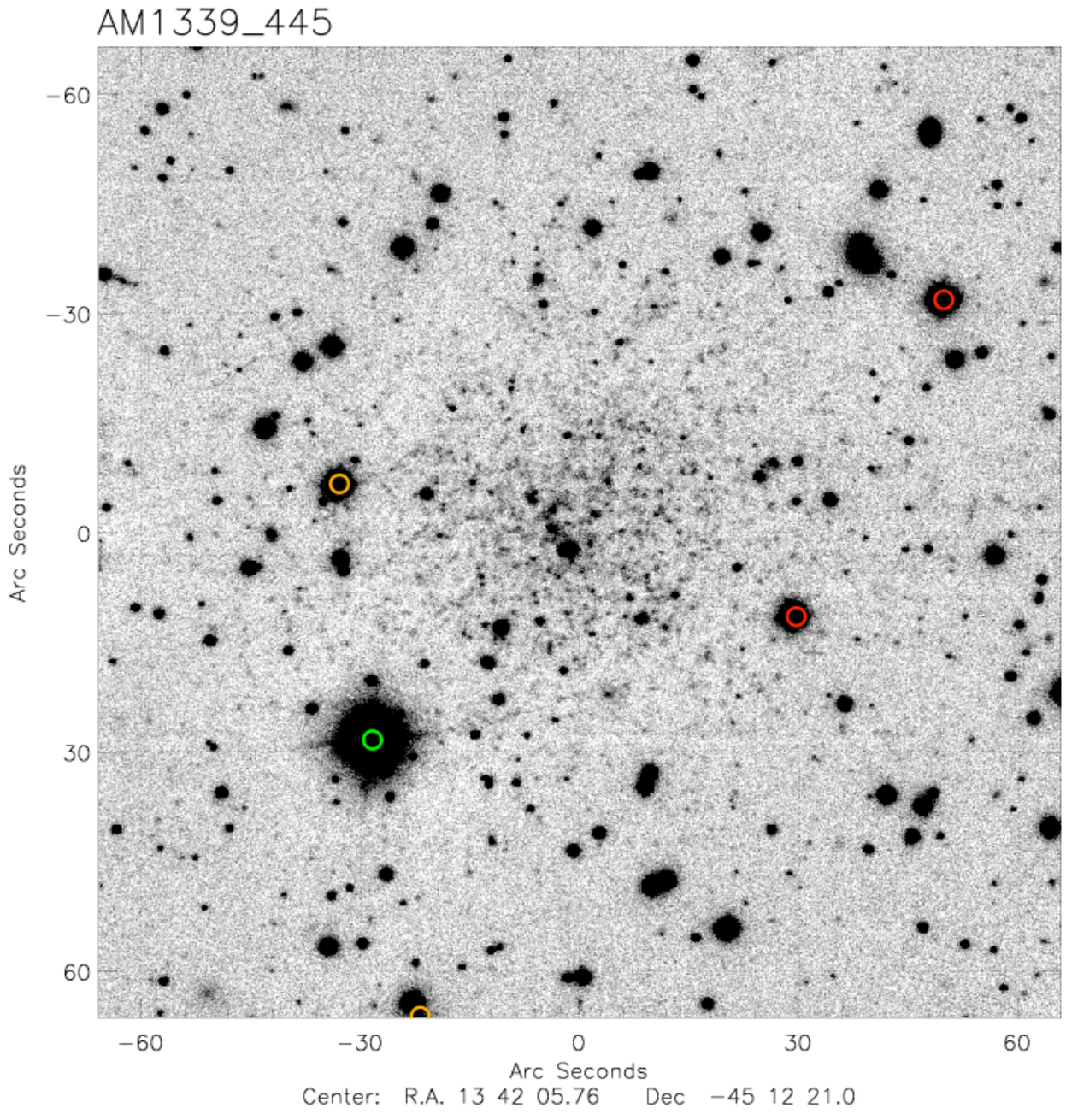
WFCAM@UKIRT K<K TRGB





high-precision photometry at the TRGB level is required

Target Galaxies

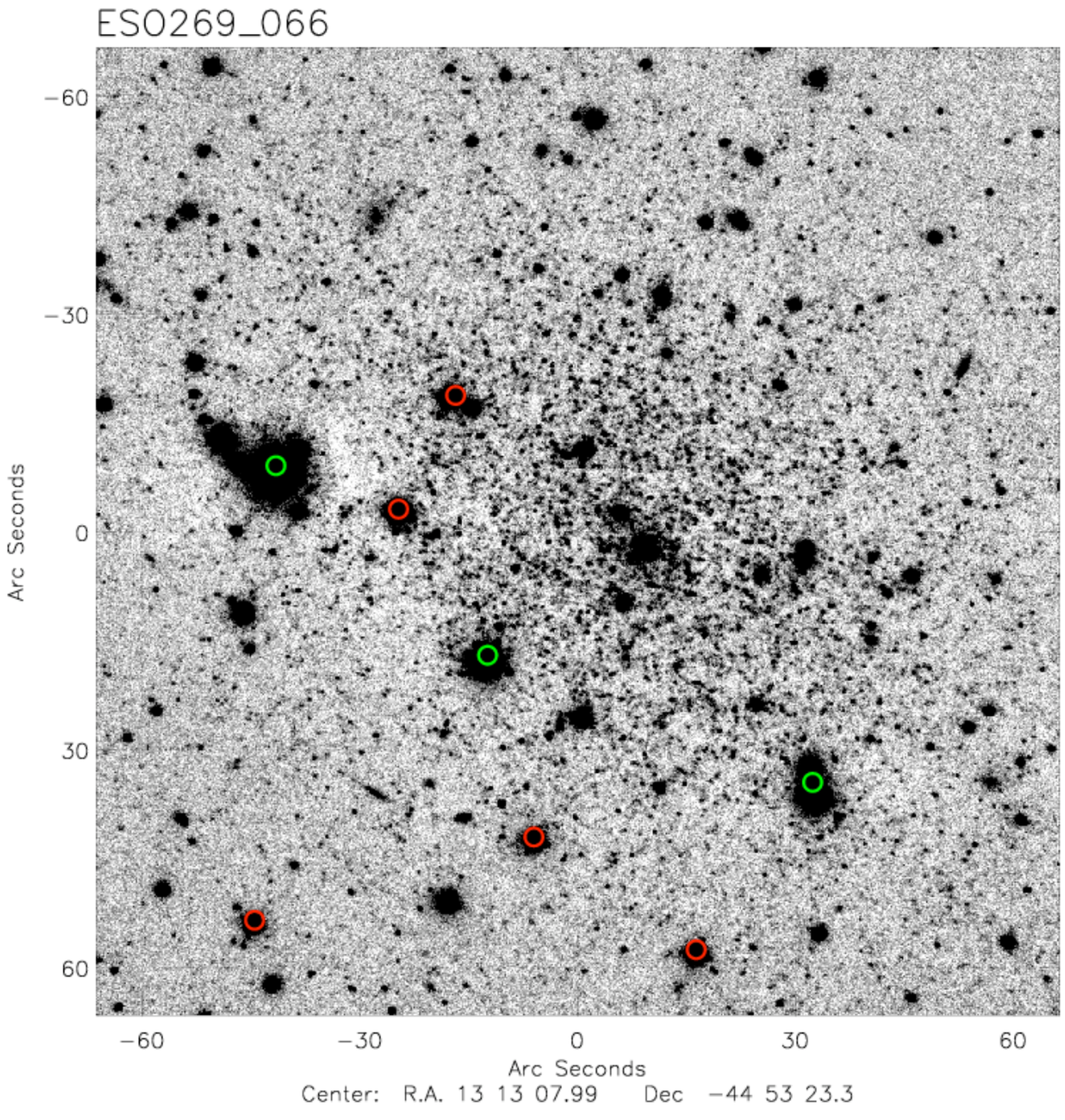


ISAAC J images

UsnoB1 magnitudes
V=(B+R)/2

17<V<16.5
16.5<V<16
V<16

Target Galaxies



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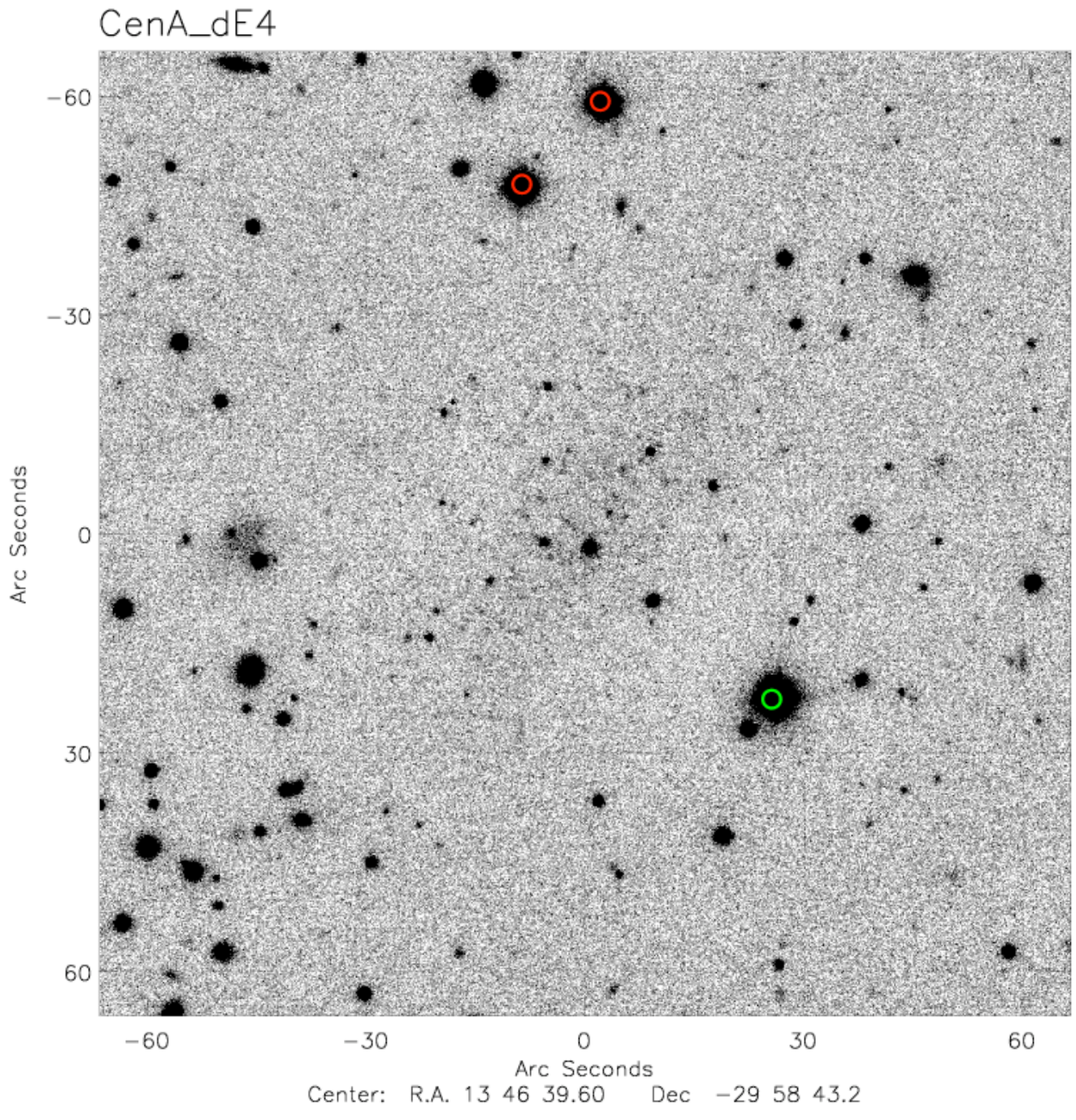

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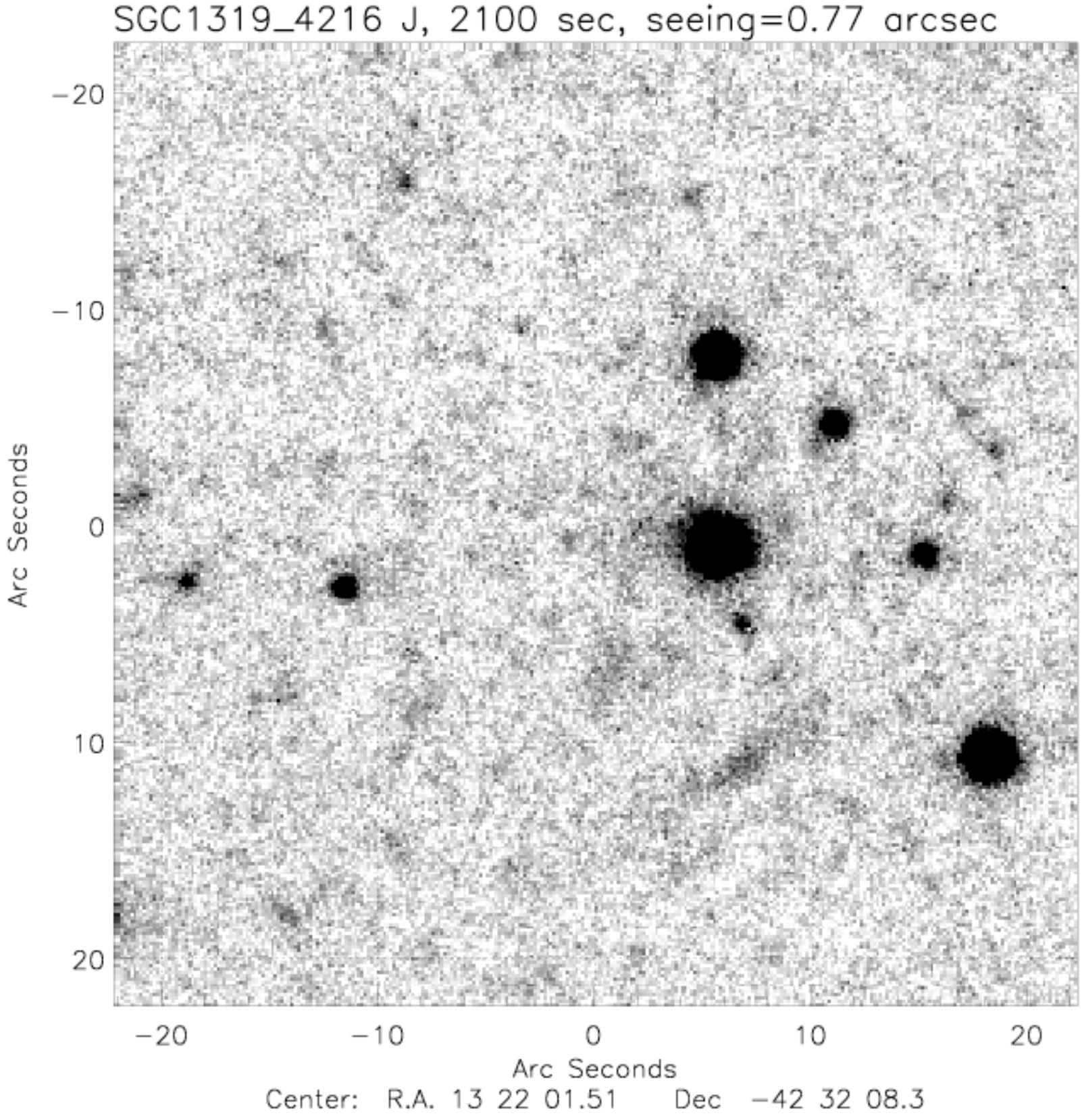
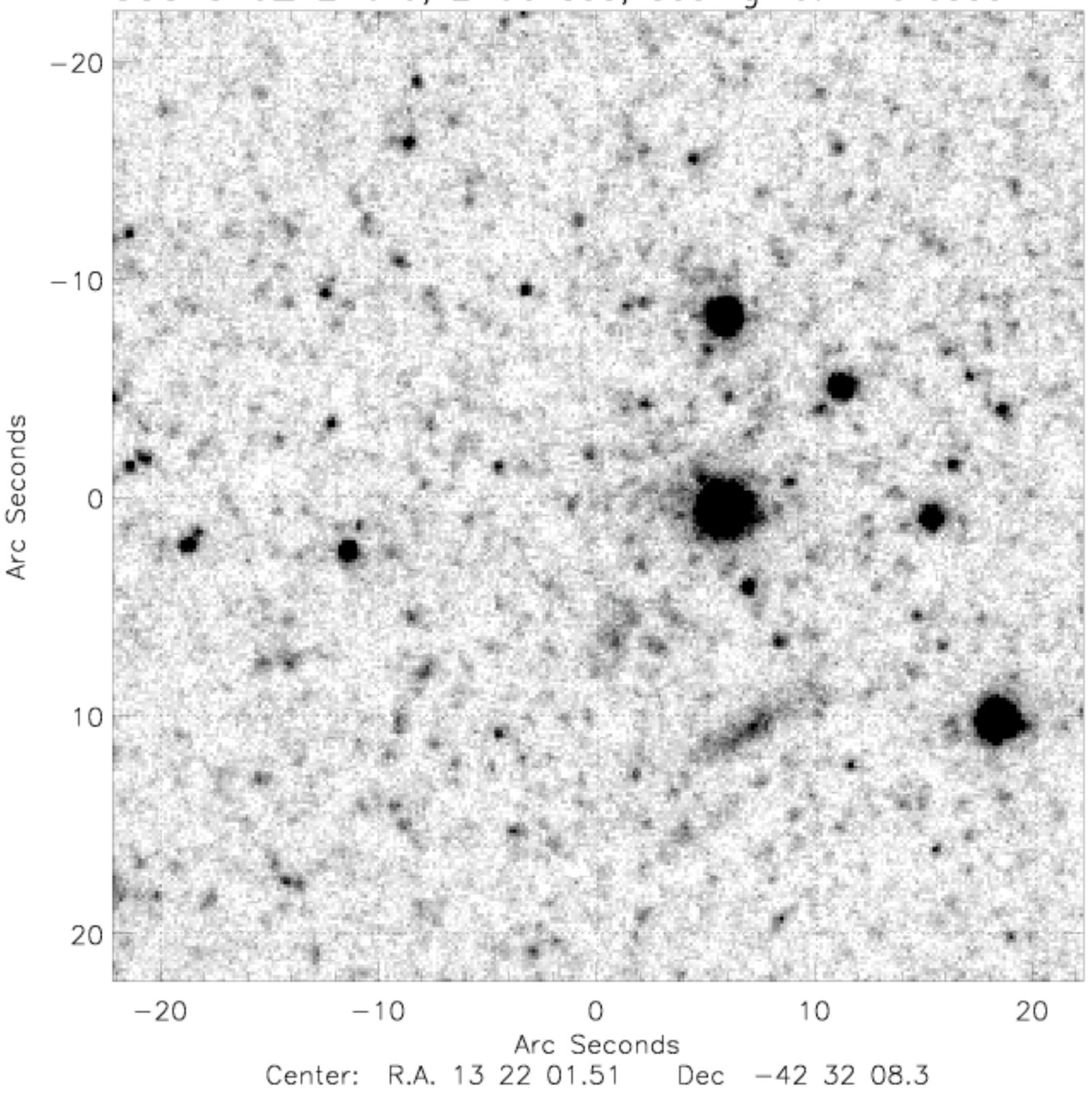

SGC1319_4216 J, 2100 sec, seeing=0.77 arcsec
−20
−10
0
10
20
Arc Seconds
−20
−10
0
10
20
Arc Seconds
Center: R.A. 13 22 01.51 Dec −42 32 08.3

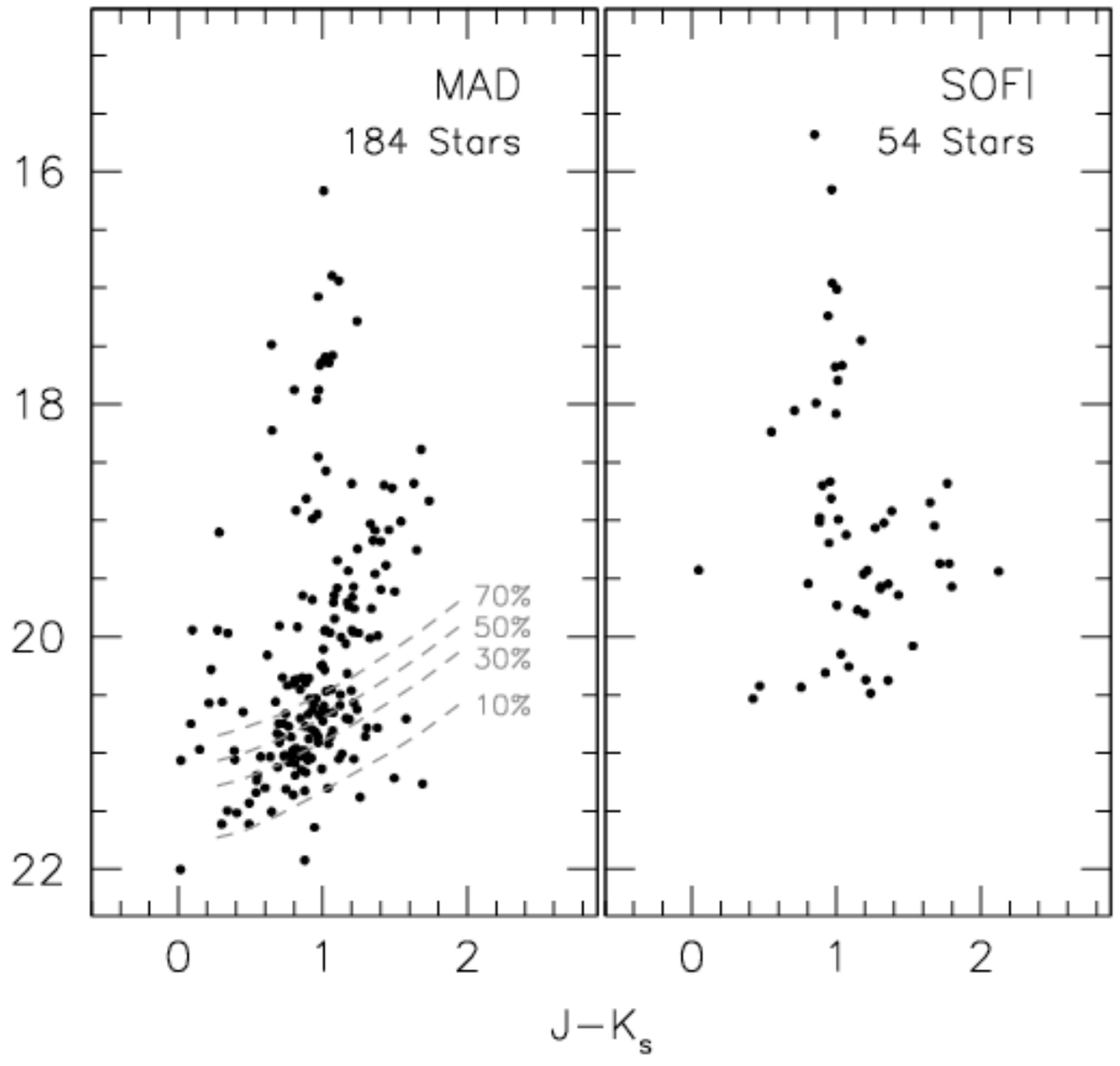

SGC1319_4216 J, 2100 sec, seeing=0.44 arcsec
−20
−10
0
10
20
Arc Seconds
−20
−10
0
10
20
Arc Seconds
Center: R.A. 13 22 01.51 Dec −42 32 08.3

Sofi vs MAD

Gullieuszik+2008

UKS2323-326
(m-M)0=26.74, 2.23 Mpc

SOFI: exptime: 20+45 min FWHM: 0.9 arcsec
MAD: exptime: 37+30 min FWHM: 0.11 arcsec



Conclusions

- In a sample of 14 dE in CenA we found 8 targets with bright stars that can be used as NGS
- ISAAC showed that such observations are feasible when seeing is <0.5 arcsec
- A 8-m telescope + AO can provide the photometric depth required to study CenA members
- Our project is feasible if we assume that MADMAX would provide good photometry for target stars at least 0.5 mag deeper than ISAAC (Ks~22)
- 2h on target in J, H, and Ks => ~1 night on each target galaxy (including overheads)

- In the Local Universe there are also many other interesting target galaxies at smaller distances (i.e. some Sculptor Group members)