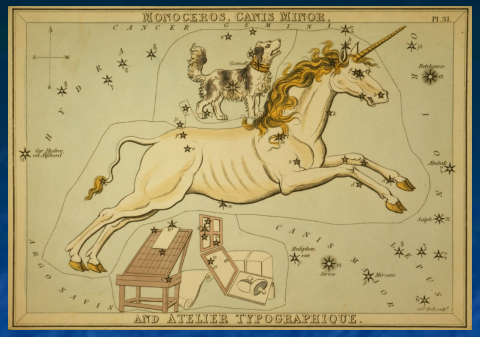

The Nature of the Monoceros Overdensity

(work in progress)

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Ed Montiel, U of Arizona

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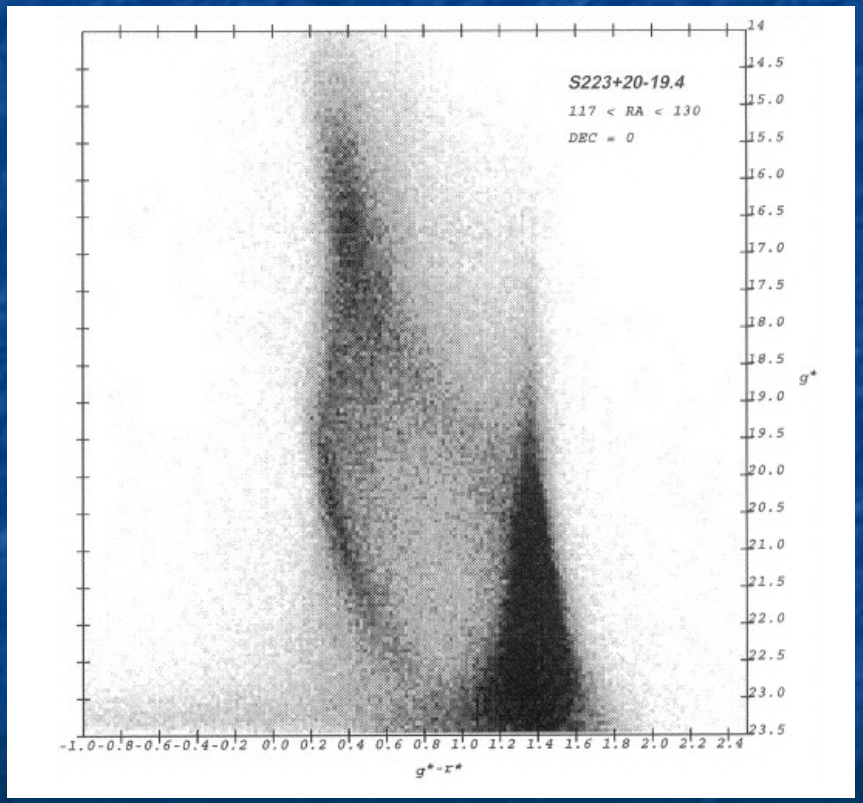
SDSS meeting, Chicago, 2008

Monoceros stream discovery

- Newberg/Yanny et al 2002
- Separate main sequence => spatial clumping
- Much followup with ‘small’ imaging fields: covers over 100 deg (Ibata et al 2003, Dinescu et al 06, Conn et al 07)
- Also see Juric et al 08, de Jong et al 08 (SDSS data)

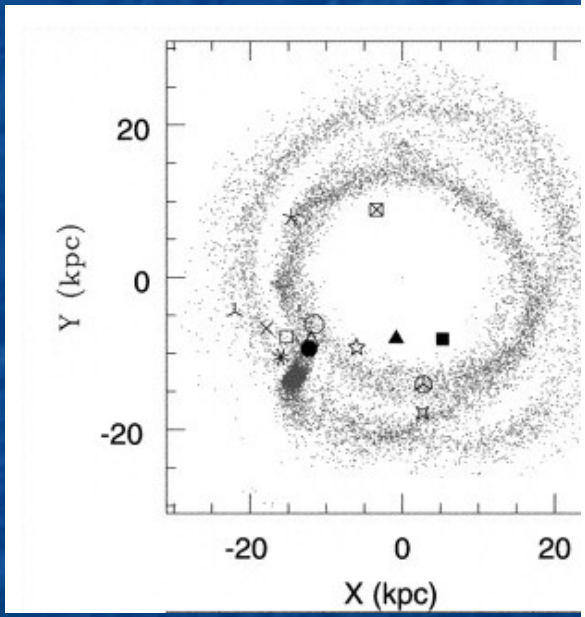


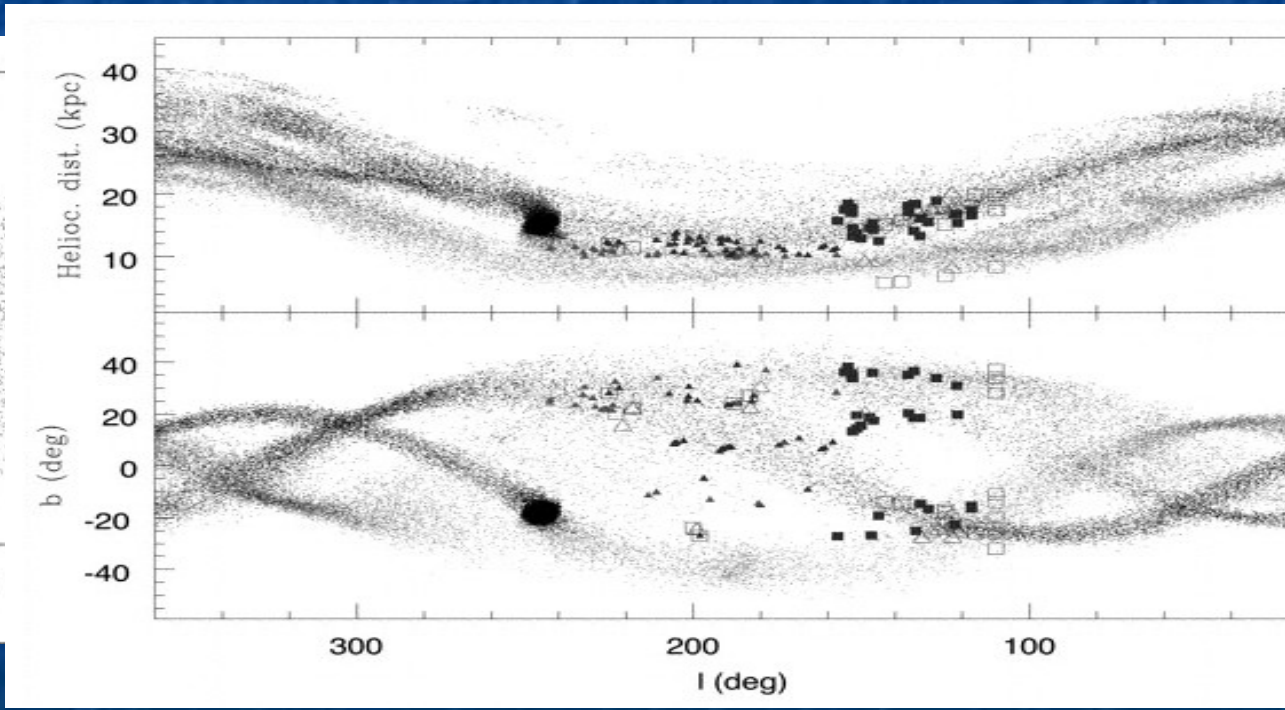
Two theories:

(1) Infalling small satellite is torn apart just outside the edge of the Galaxy's disk; it happened to end up on a nearly circular orbit (Penarrubia et al 2005)

(2) A much bigger satellite collided with the disk, giving it a warp and a flare and leaving ring-like structures (Kazantzidis et al 2008, Younger et al 2008)

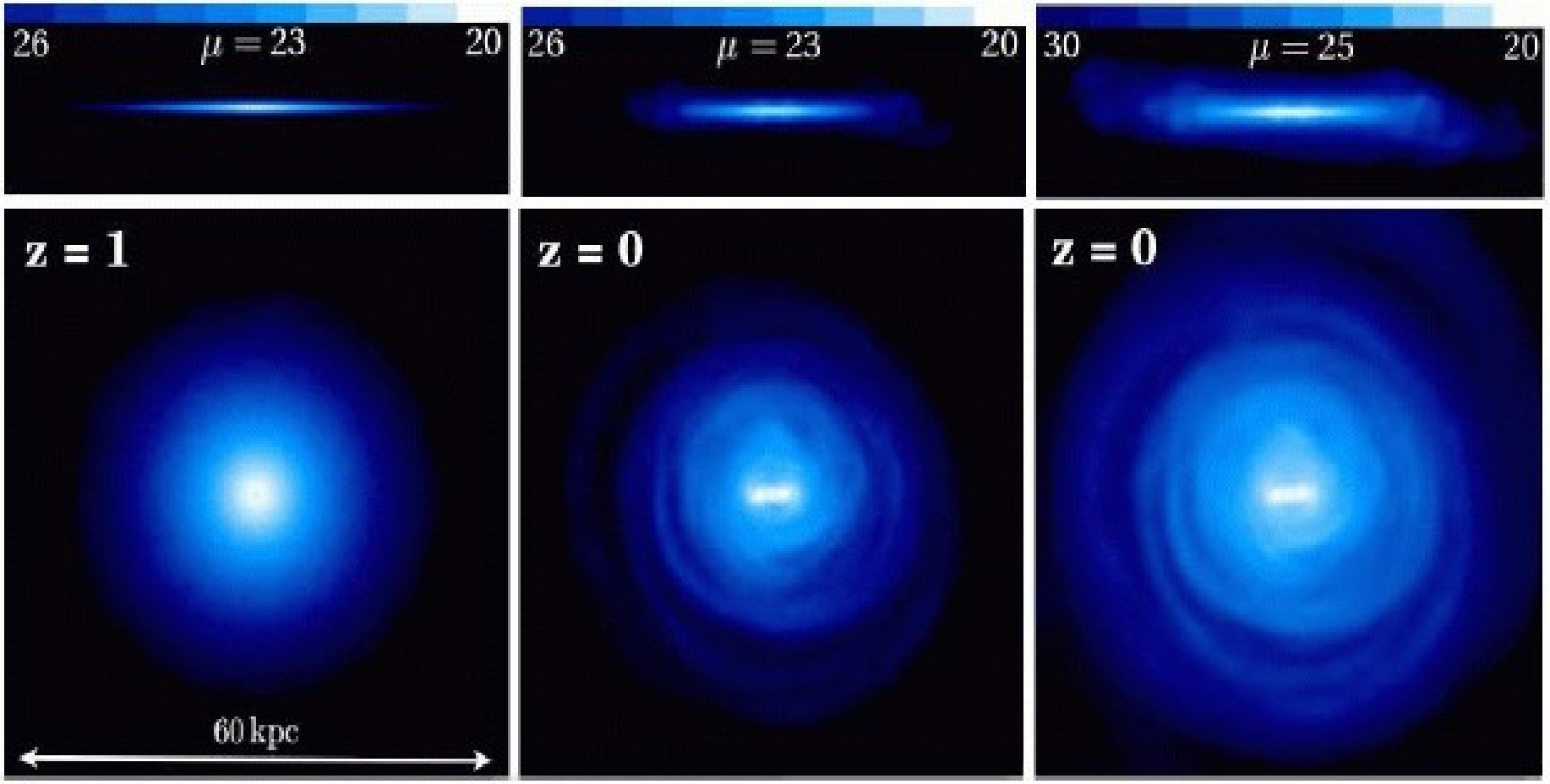
Satellite debris (small, metal-weak satellite)





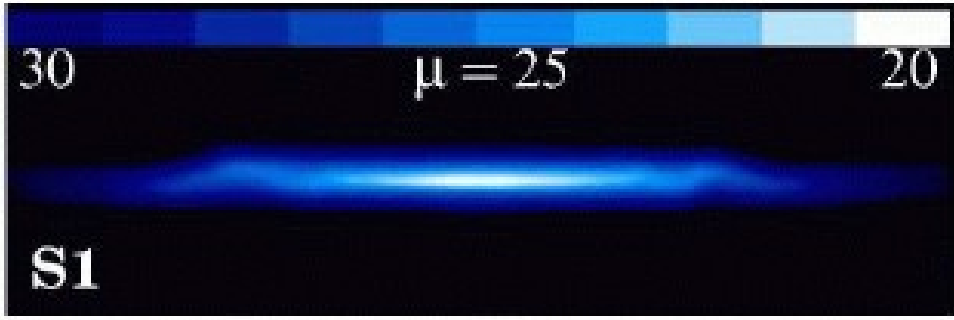
Penarrubia et al 2005

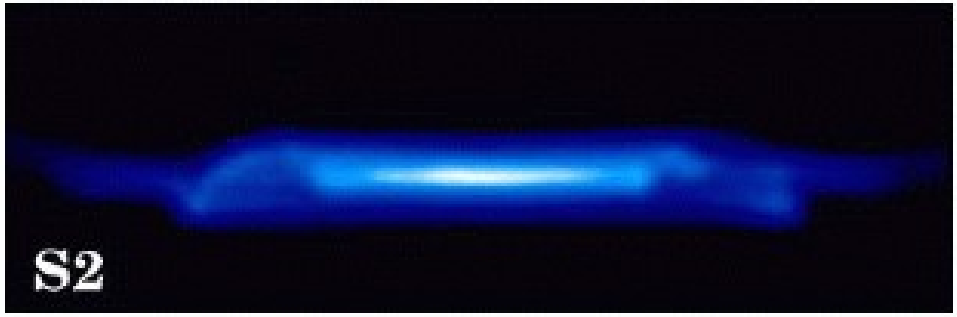
A larger infalling satellite chews up the disk too:

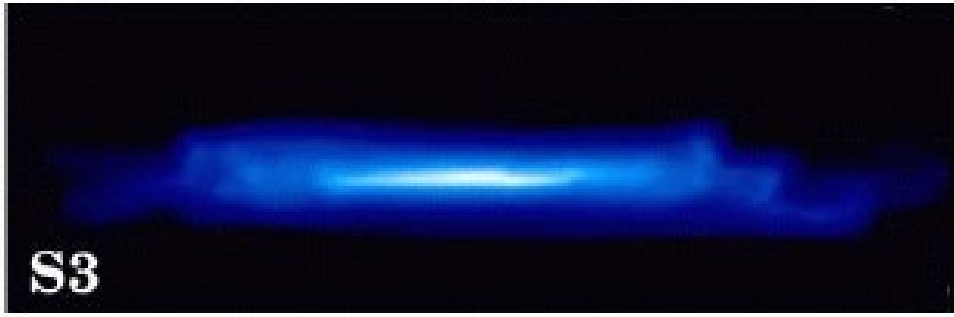


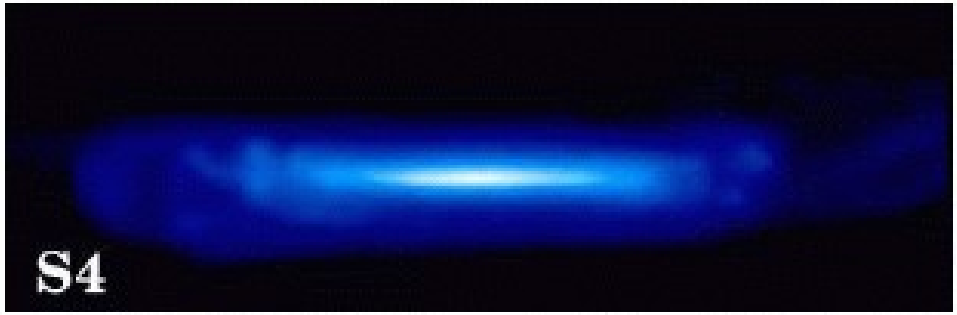
Kazantzidis et al 2008

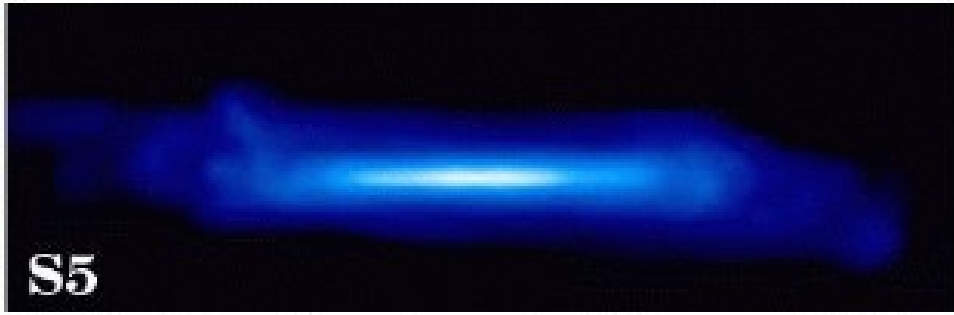
Warps, flares, rings …





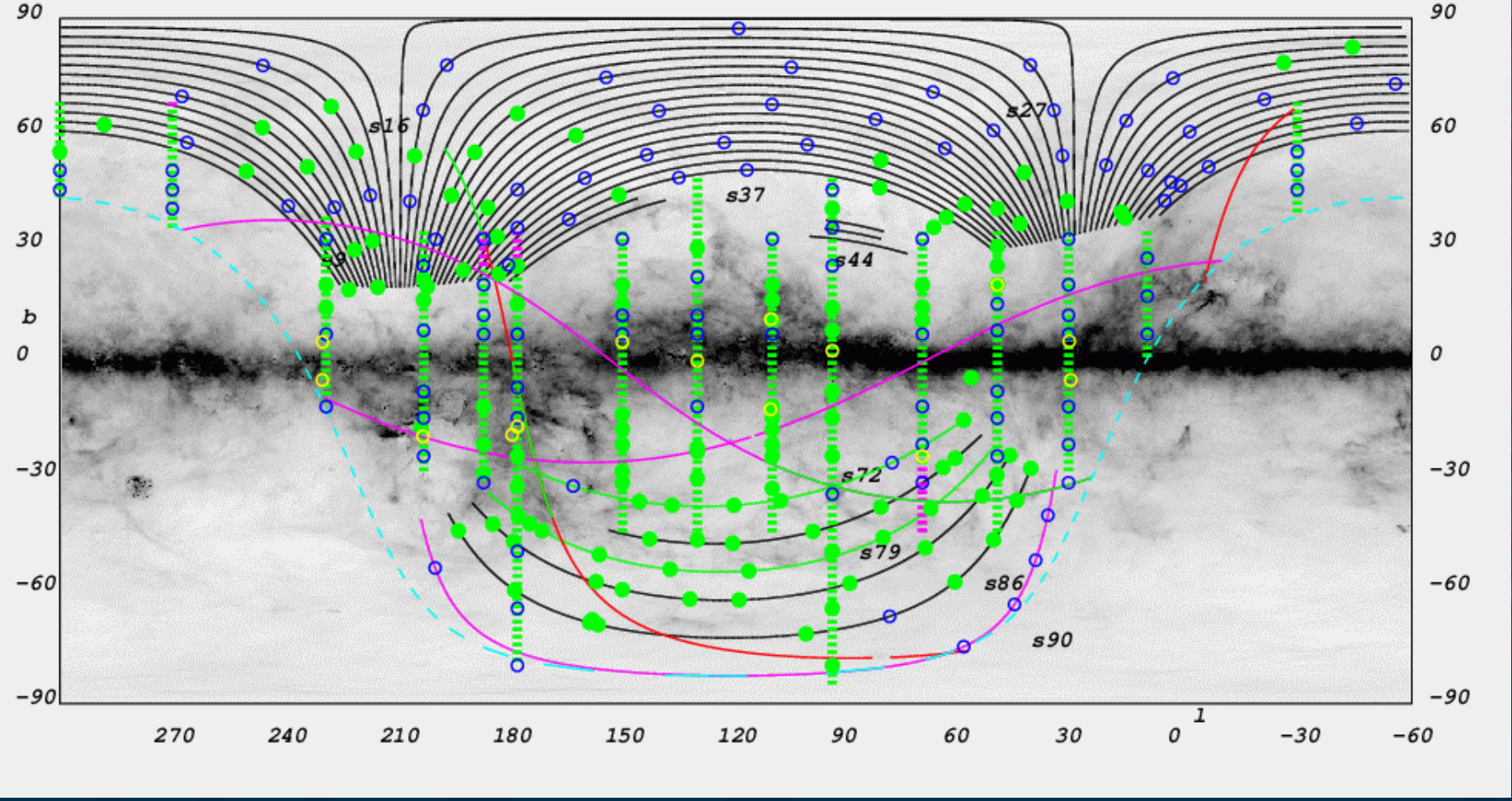


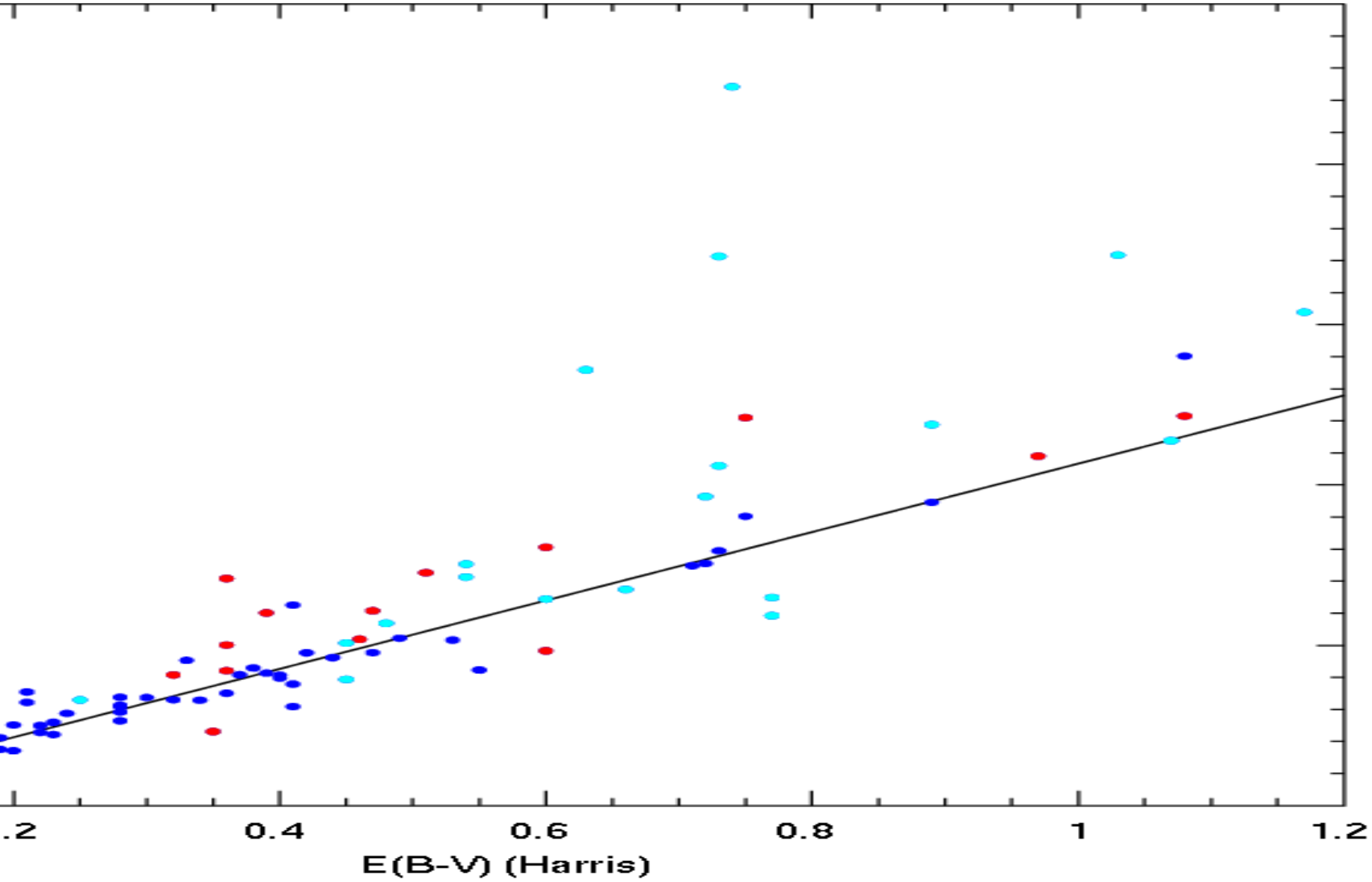




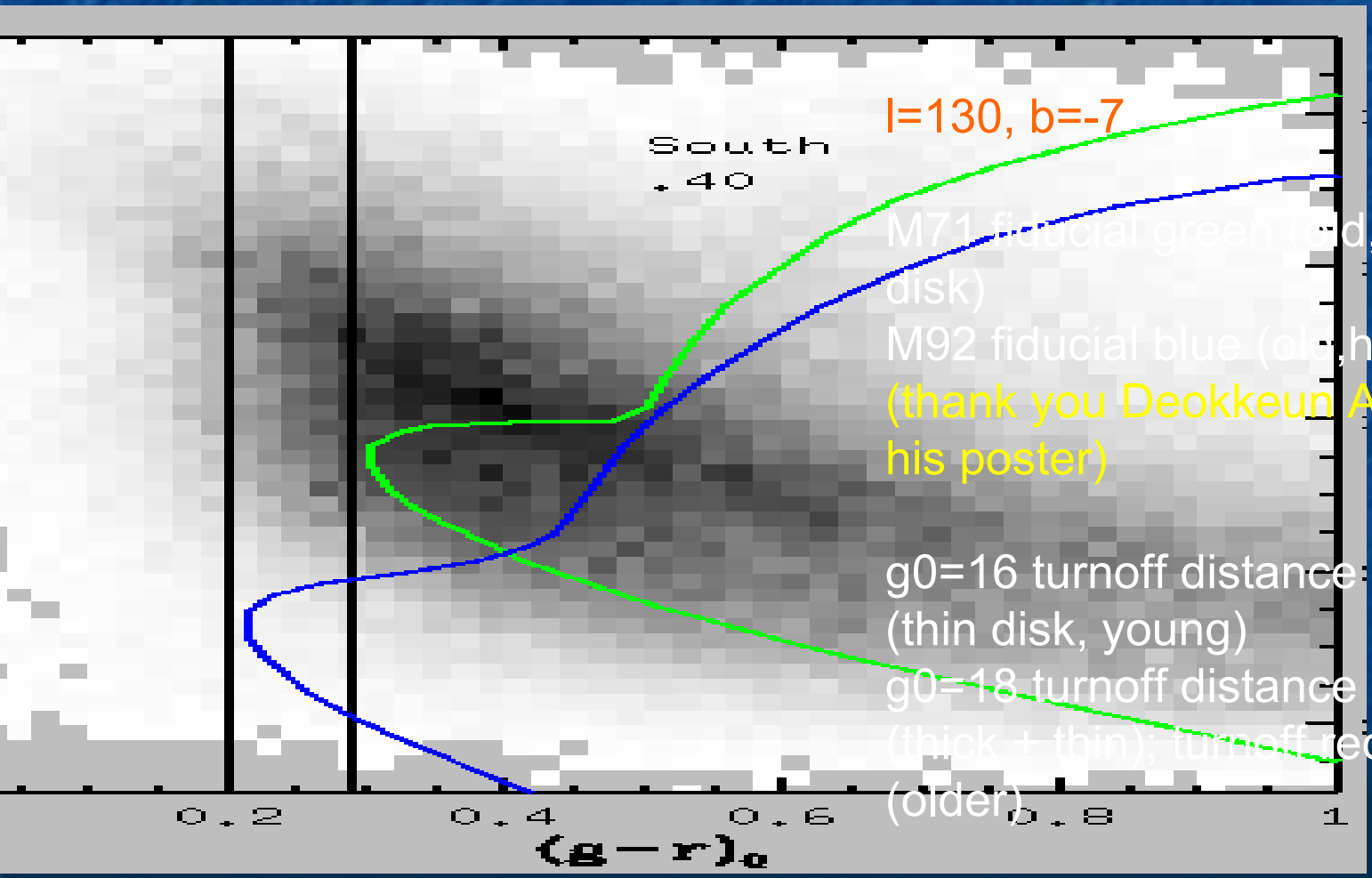
Kazantzidis et al 2008

SEGUE stripes across the plane




.2
0.4
0.6
0.8
1
1.2
E(B-V) (Harris)

CMD reading:



l=130, b=-7

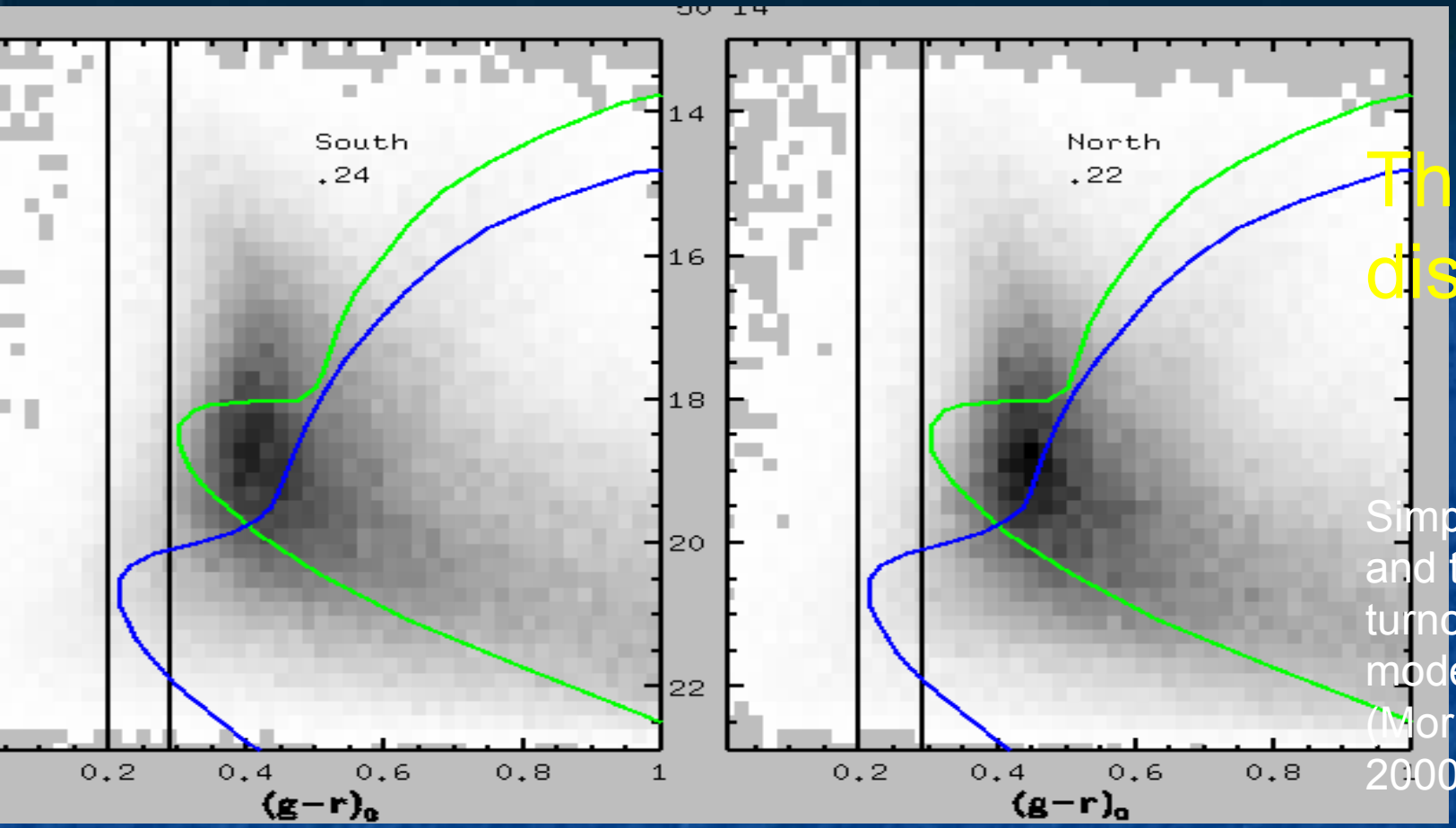
M71 fiducial green (old, thick disk)

M92 fiducial blue (old,halo)

(thank you Deokkeun An….. see his poster)

g0=16 turnoff distance 0.2 kpc (thin disk, young)

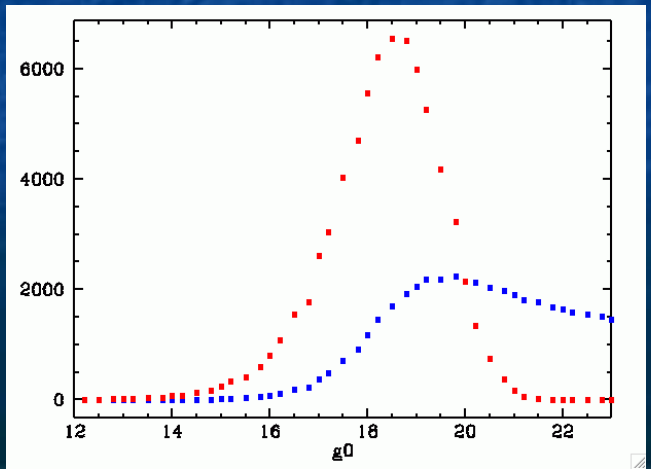
g0=18 turnoff distance 0.5 kpc (thick + thin); turnoff redder (older)



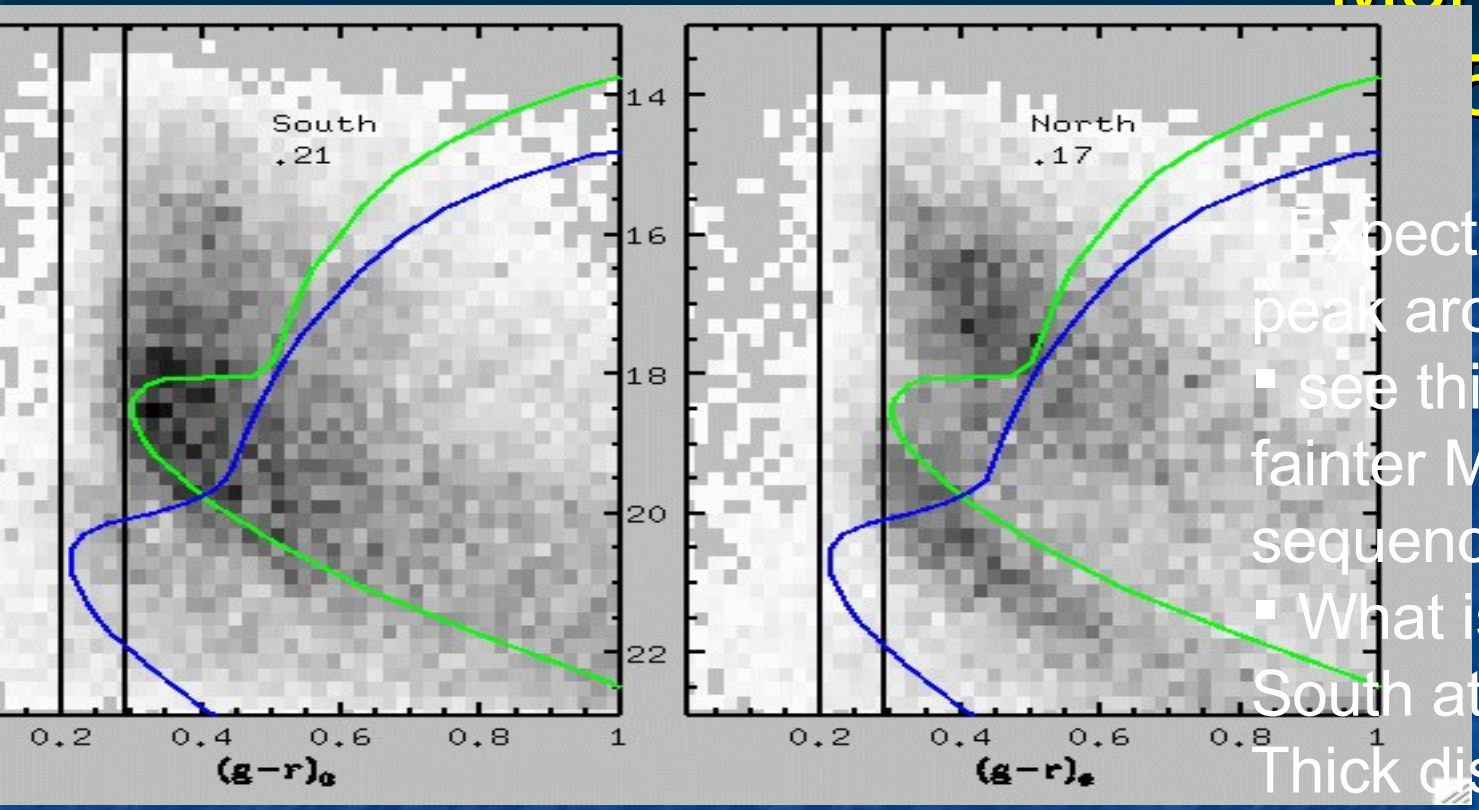
Thick disk:

Simple halo and thick disk turnoff star model (Morrison et al 2000):

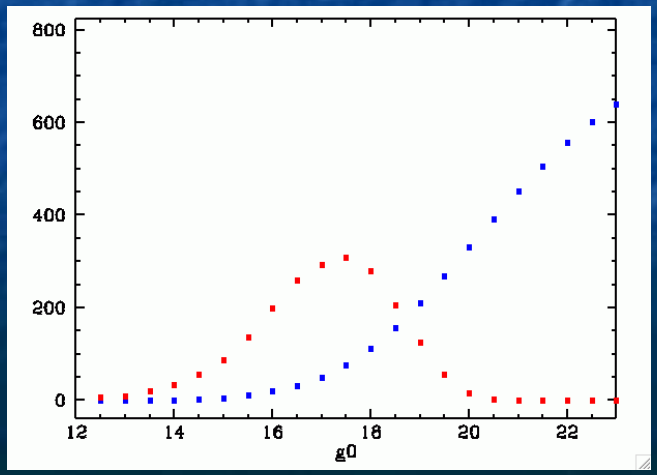
- l=50,b=+/-14: model predicts thick disk peaks around g0=19, 2 kpc; we see this
- Thick disk turnoff redder than expected (abundance gradient?)
- Halo visible around g0=20
- Photometry incomplete for g0>21



Monoceros: 50 b=20

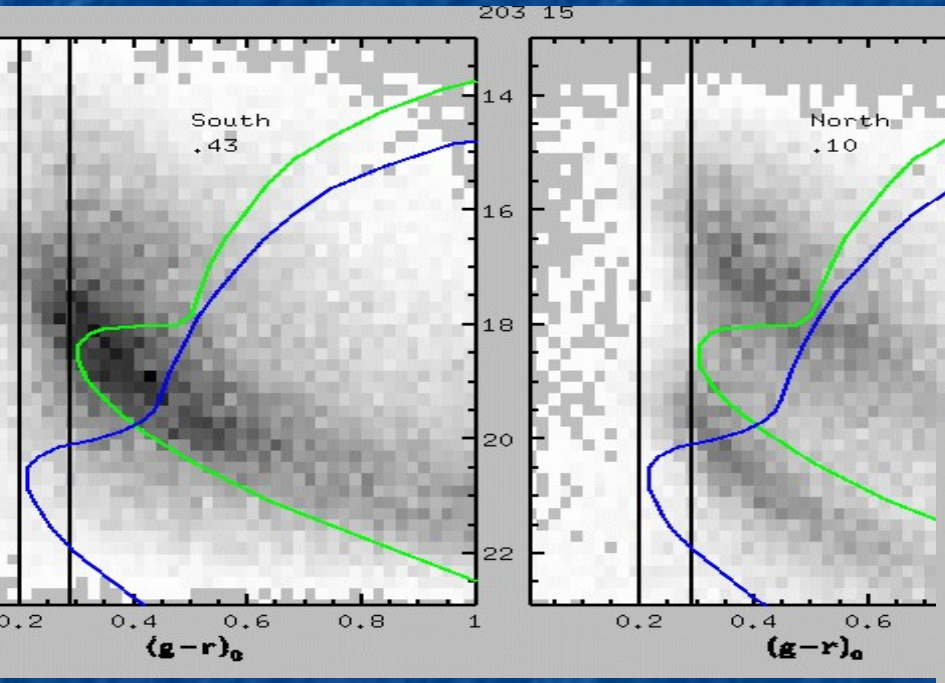


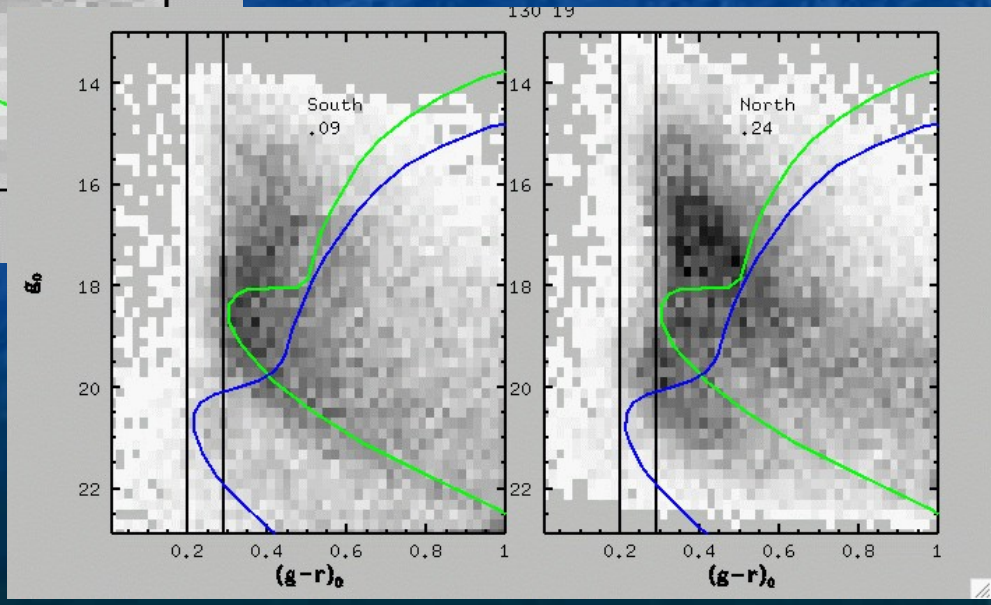
- Expect thick disk to peak around g0=17
- see this in North, plus fainter Monoceros sequence
- What is feature in South at g~18?? Halo? Thick disk?



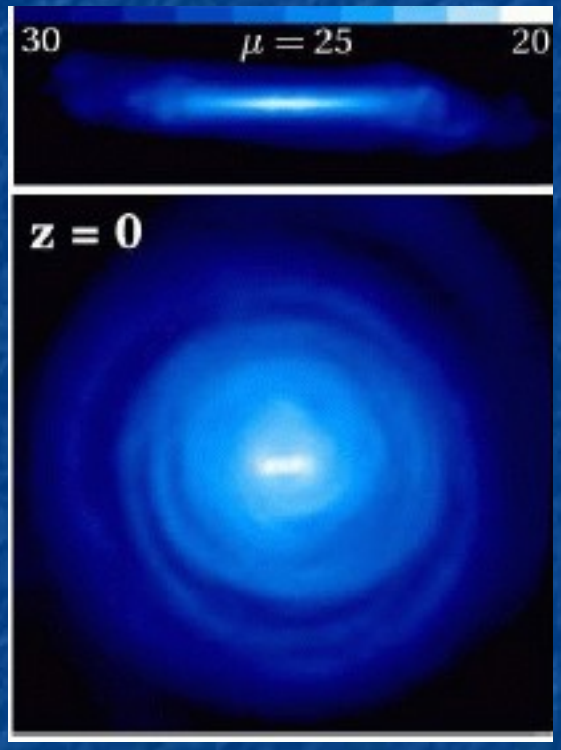
- Unbiased F/G spectra are metal-rich with disky kinematics
- Asymmetric thick disk!

We see similar asymmetries at l=94, 110, 130, 150, 203





To understand Monoceros, first understand the thick disk

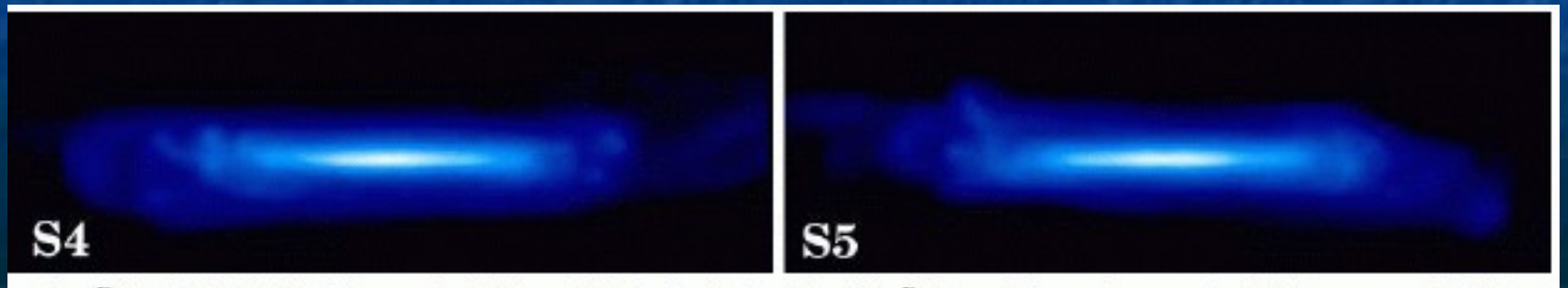


We see many of the features predicted by Kazantzidis et al (2008) in our own outer thick disk:

-- Rings covering more than 90 degrees

-- Asymmetries

Simplest explanation of Monoceros is that it is part of the signature of accretion event(s) that heated, warped and flared our disk



Summary

- Can use the SDSS-SEGUE stripes through the galactic plane to constrain Monoceros
- SFD reddenings work well for E(B-V)<0.5
- We see significant asymmetries in the thick disk in N/S comparisons over more than 100 degrees where Monoceros seen in N
- Consistent with predictions of formation via accretions(s) that heat & flare disk

Thanks .....