Galactic Science with BigBOSS

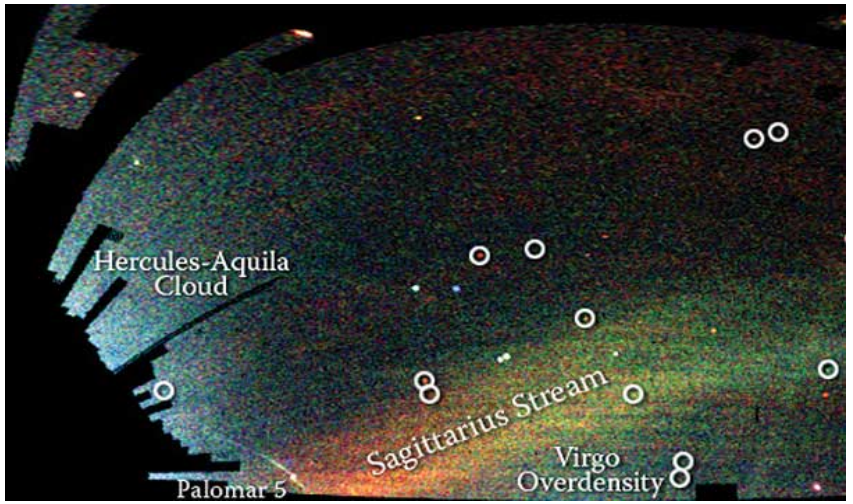
Marla Geha (Yale)

Galactic Science with BigBOSS

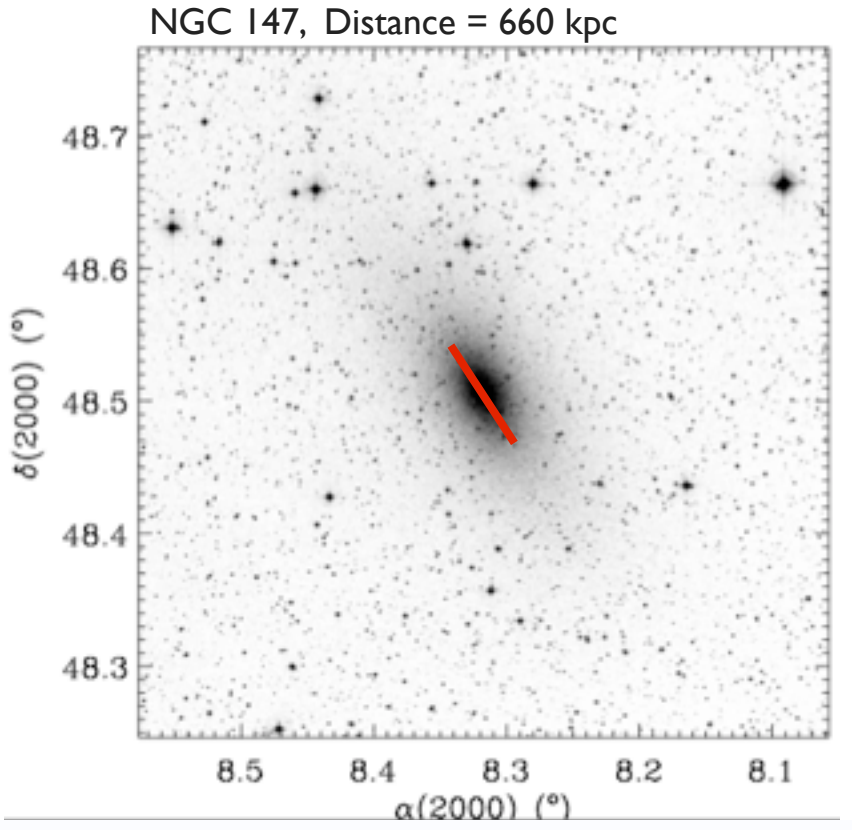
What are the structural, kinematic, and chemical properties of galaxies?

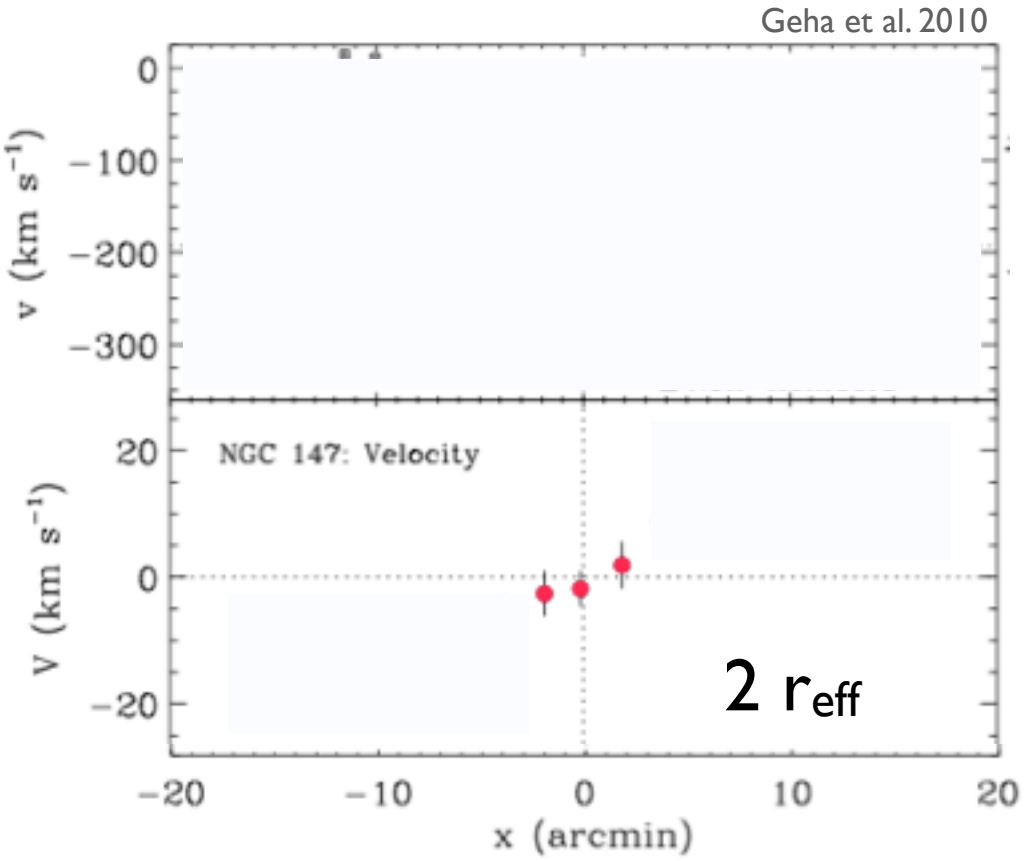
Beyond the Local Group, can only study integrated light from galaxies.

Individual star spectroscopy provides significantly more detail to tremendously deeper surface brightnesses.



Galactic Science with Individual Stars

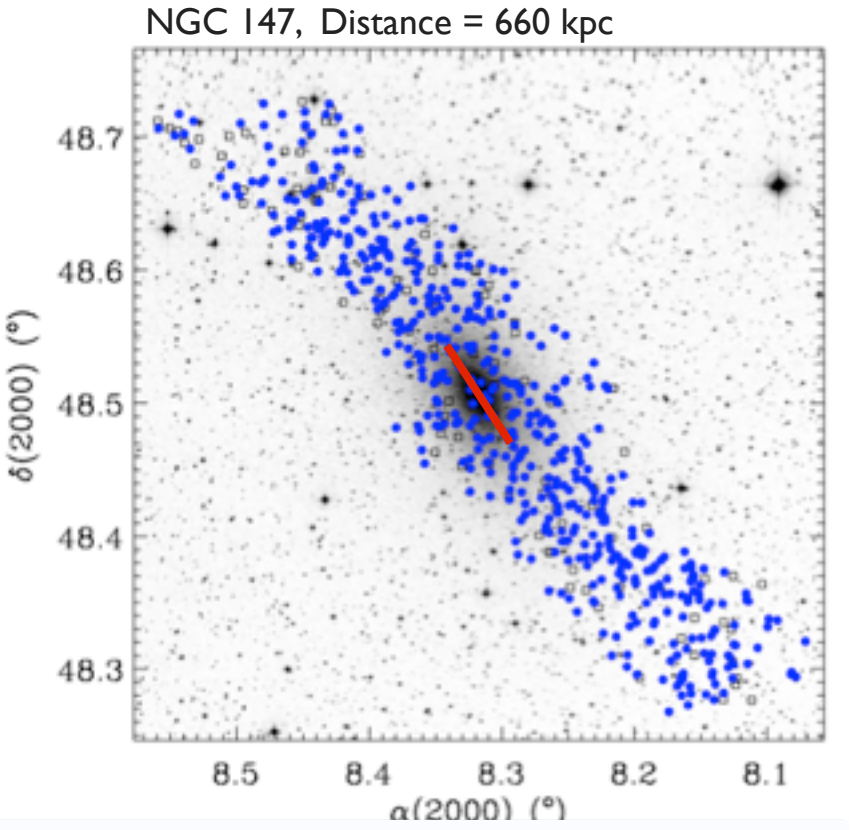


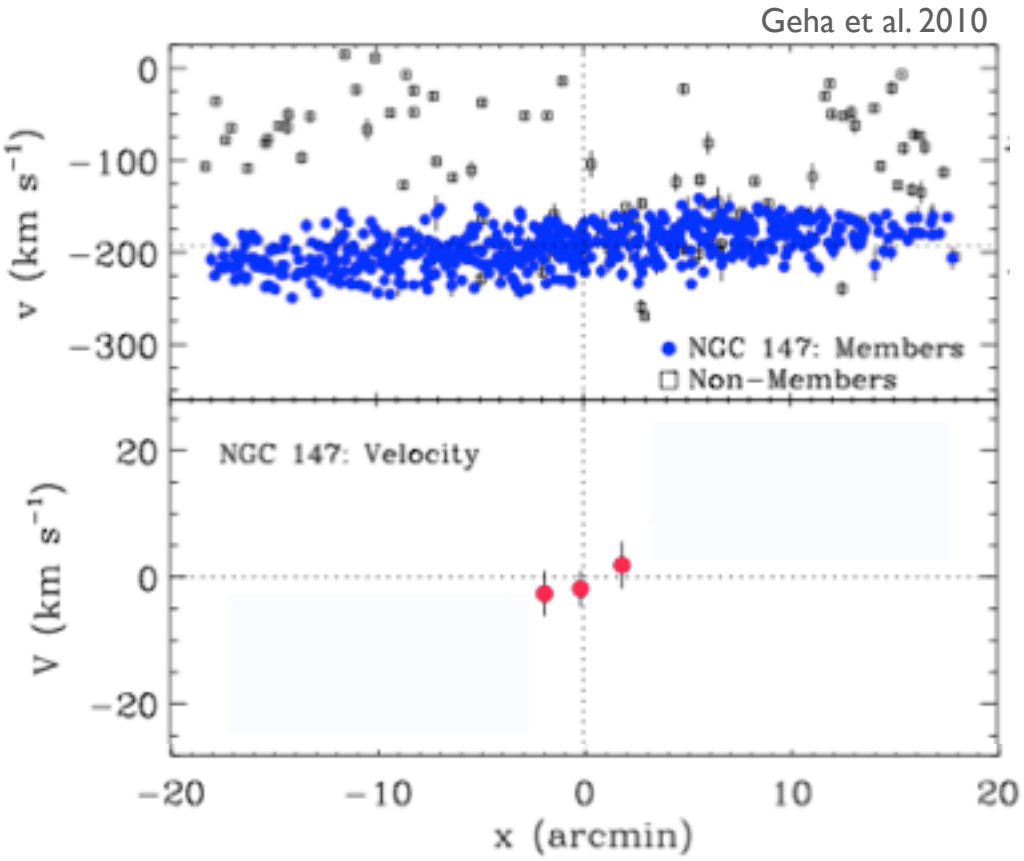


Integrated light spectroscopy limit ~ 23 mag arcsec^{-2}

Individual star limited by purity of sample ~ 35 mag arcsec^{-2}

Galactic Science with Individual Stars

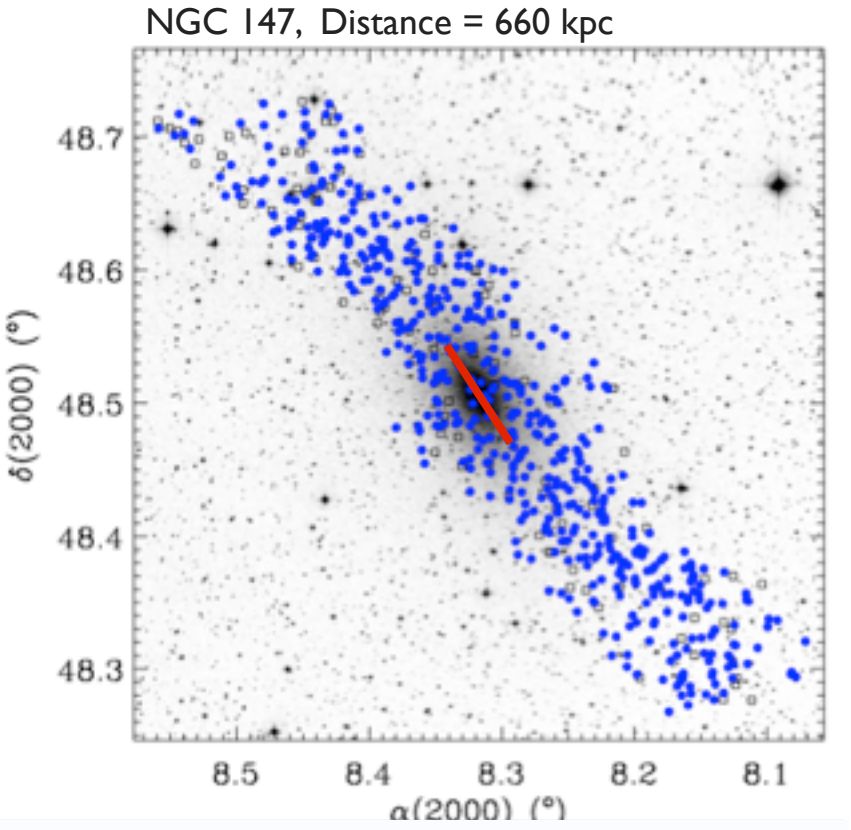


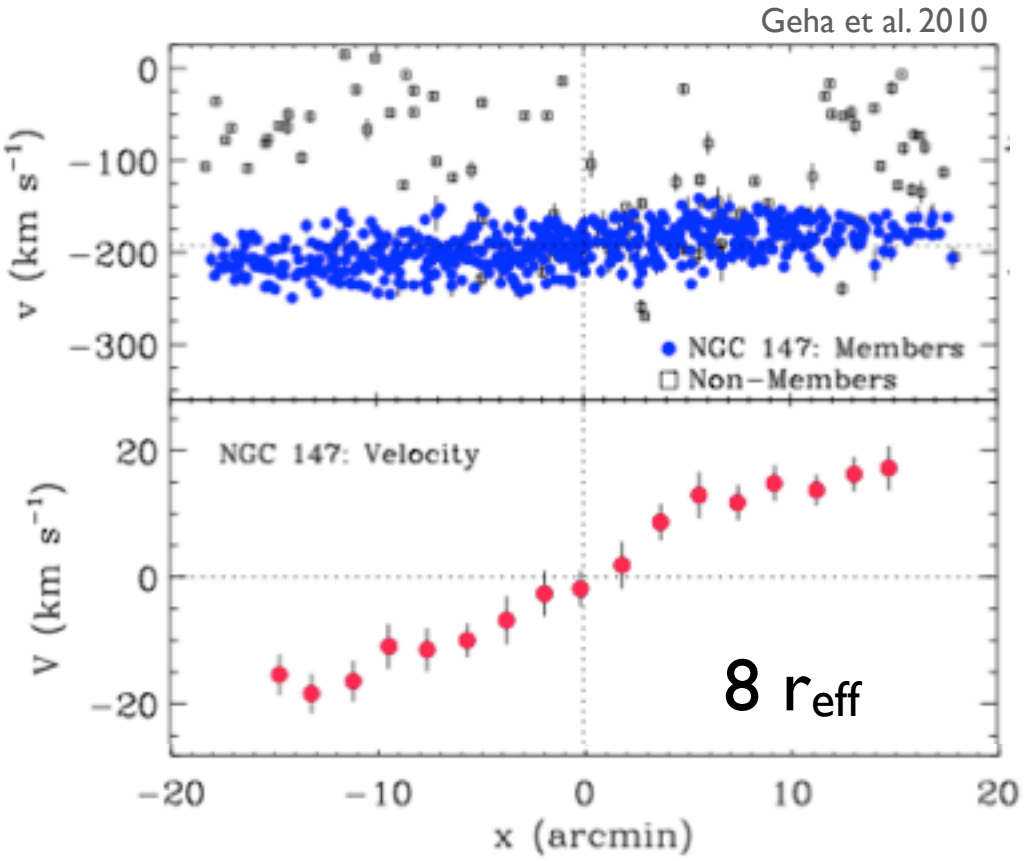


Integrated light spectroscopy limit ~ 23 mag arcsec^{-2}

Individual star limited by purity of sample ~ 35 mag arcsec^{-2}

Galactic Science with Individual Stars



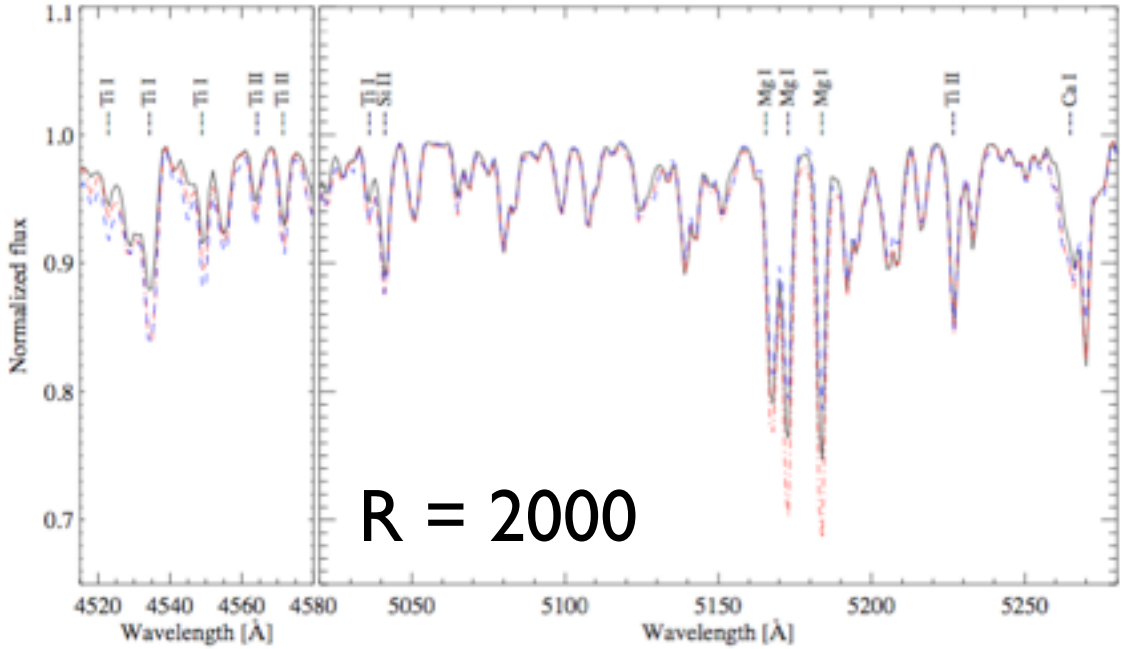


Integrated light spectroscopy limit ~ 23 mag arcsec^{-2}

Individual star limited by purity of sample ~ 35 mag arcsec^{-2}

Galactic Science with Individual Stars

Lee et al. (2011)

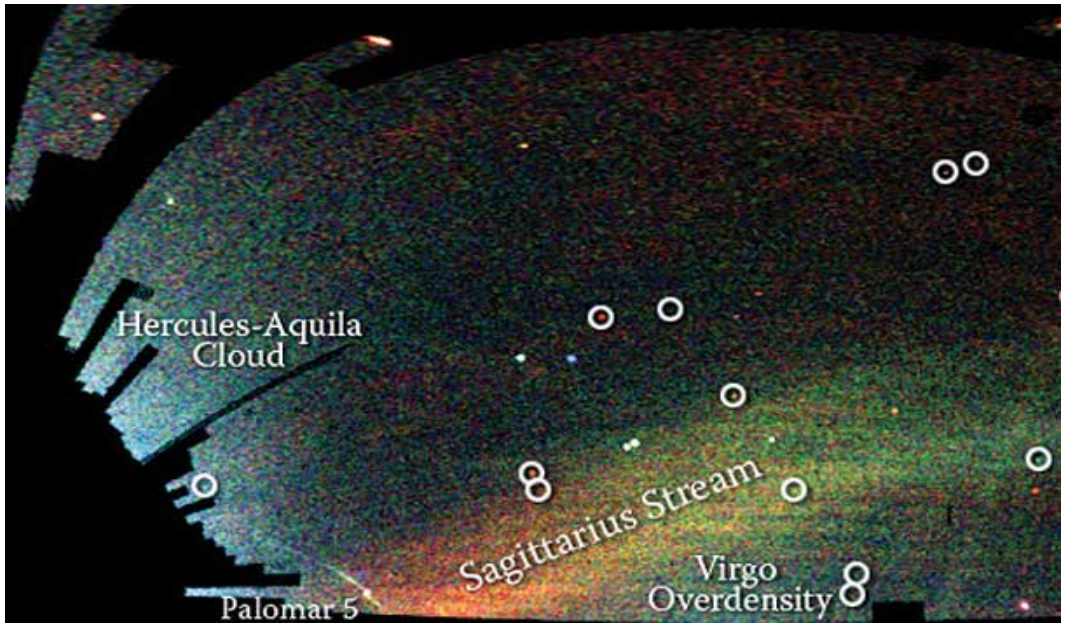


The Metallicity Distribution Function (MDF) of a stellar population can be used to infer its SFH and IMF.

Metallicity can also be used to better define subpopulations (e.g. 7D phase space).

SDSS SSP: Accuracy of 0.25 dex in [Fe/H] (Smolinski et al. 2011)
0.1 dex in [α/Fe] (Lee et al. 2011)

Galactic Science: SDSS vs. BigBOSS



SDSS photometric limit r ~ 22

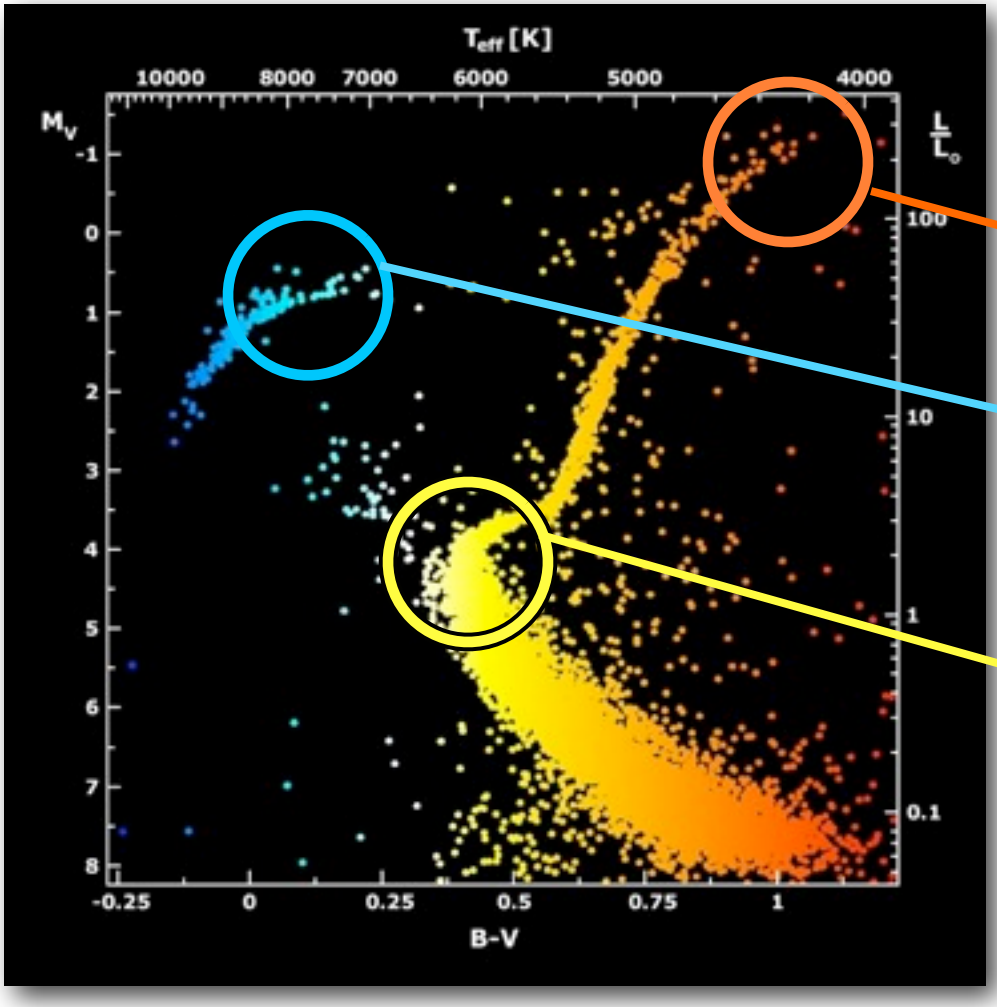
SDSS spectroscopic limit r ~ 17.7

SDSS SEGUE r ~ 20

- On-going/planned spectroscopic surveys are relatively shallow: RAVE/ HERMES (V<14), LAMOST (13 < g < 19.5), APOGEE (H<13)
- Gaia astrometry+spectrophotometry for 1 billion stars to V<20 but radial velocity only to V<17

SDSS SEGUE vs. BigBOSS: 2-hour exposure

S/N ~ 10: g ~ 20.3 g ~ 21.5



Brightest RGB/AGB

SDSS: 200 kpc

BigBOSS: 1000 kpc

BHB stars

SDSS: 30 kpc

BigBOSS: 200 kpc

MS stars

SDSS: 8 kpc

BigBOSS: 50 kpc

Galactic Science with BB Community Fibers

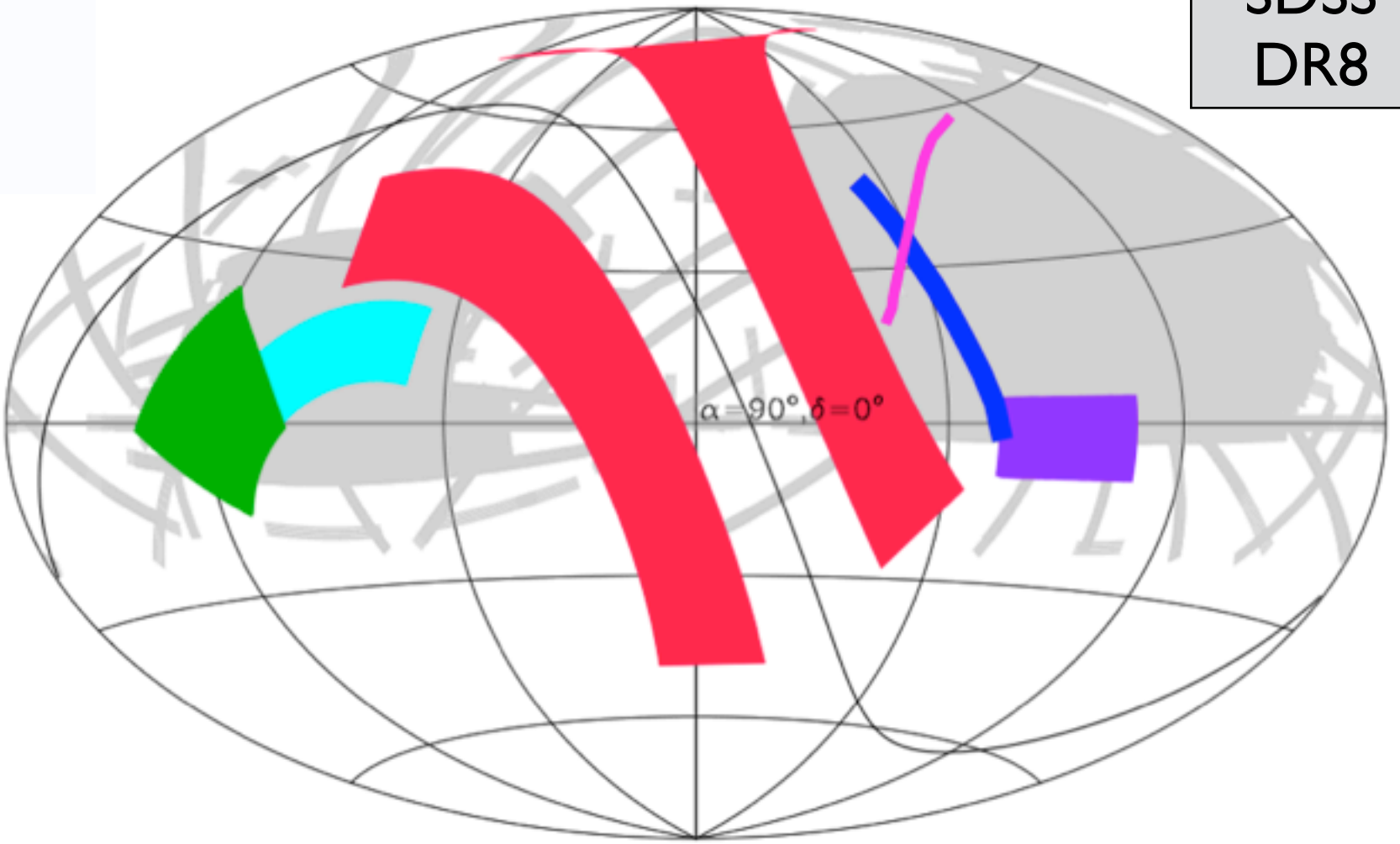
MW is covers full sky, many tracers are sparsely distributed.

1. RR Lyrae: Search for substructure that is no longer spatially coherent using tracer populations (~ 4 RRL per BB pointing, B. Sesar)

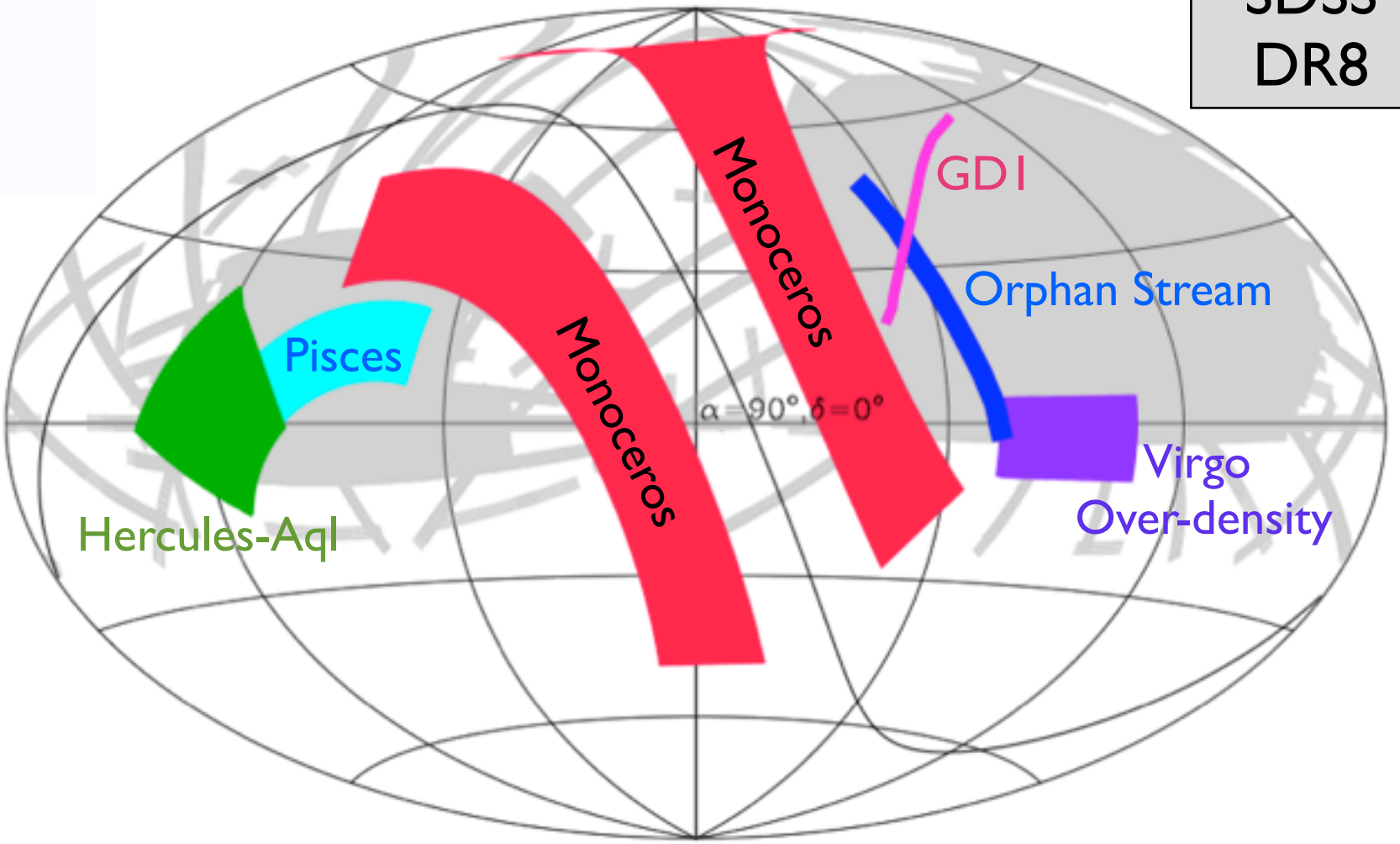
2. Blue Horizontal Branch stars: Study structure of more distant MW halo, need improved u-band photometry to properly pick out candidates (P. Harding)

3. Gaia Follow-up: Target stars with proper motions, but no radial velocities ($17 > V > 20$) to produce 6D phase space maps.

Known Stellar Streams of the Milky Way



Known Stellar Streams of the Milky Way



Targeted Galactic Science

MW is covers full sky, many tracers are sparsely distributed.

1. Galactic Structure: Study kinematics and chemistries of MW bulge, disk, halo

2. Known Halo Substructure: Study structure of more distant MW halo, need improved u-band photometry to properly pick out candidates (P. Harding)

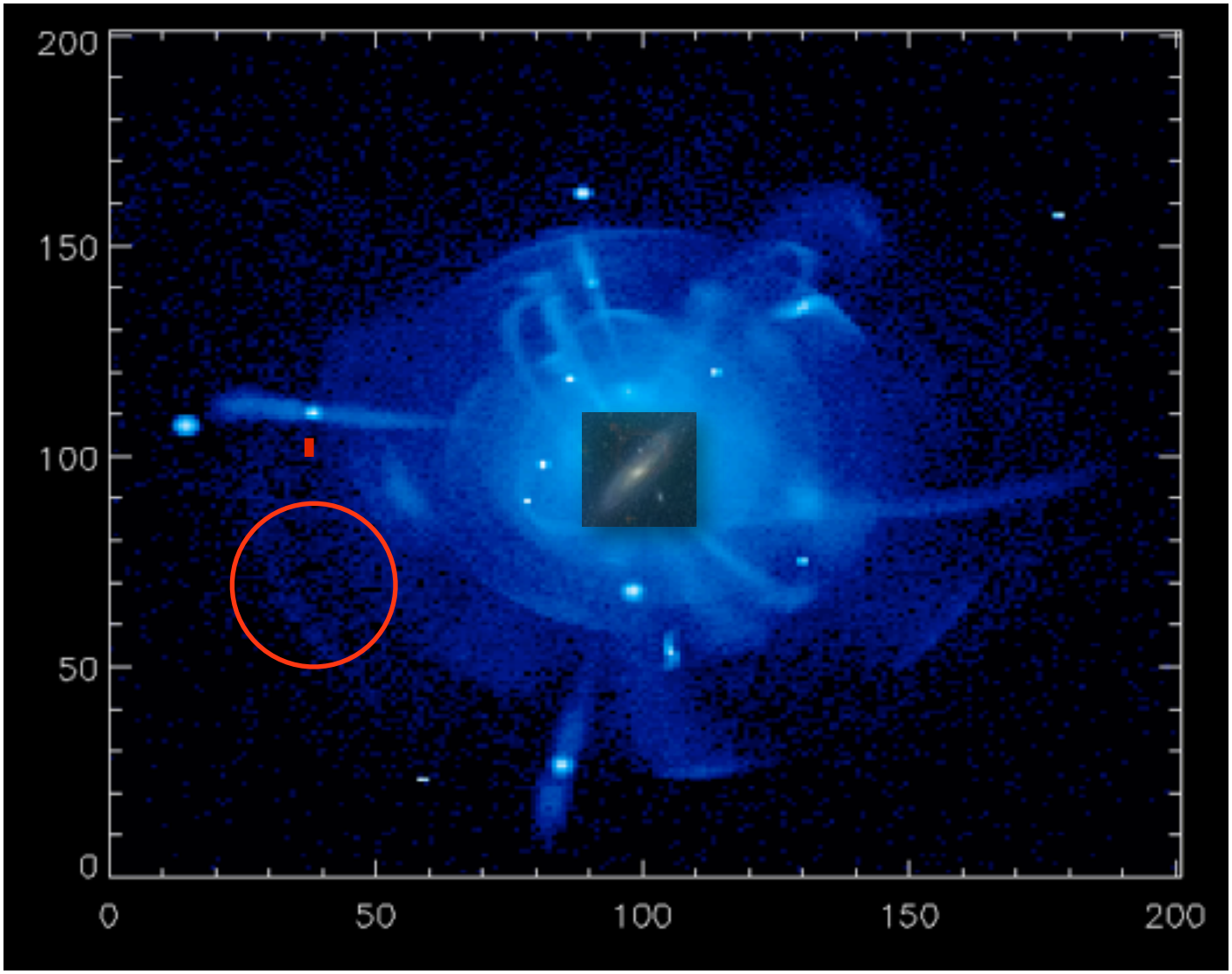
3. M31 disk + halo: Study structure of more distant MW halo, need improved u-band photometry to properly pick out candidates (P. Harding)

BigBOSS + M31

M31 is 700 kpc in distance, main disk subtends ~ few degrees

Velocity and abundance mapping of M31's inner disk via HII regions (S. Courteau).

BigBOSS + M31



Search for substructure in M31 halo.

Galactic Science with BigBOSS

- Community BB fibers targeting RR Lyrae/BHB stars
- Community BB fibers, Gaia follow-up
- Velocities/chemistries of MW Galactic Center, thin/thick disk
- Velocities/Chemistries of known MW substructure
- M31 Disk/Bulge
- M31 halo + substructure

Present + Future Galactic Spectroscopic Surveys

	FOV/N_{fiber}	R	Lim. Mag	Science Focus
SEGUE	7°, 1000	R~2000	g < 20.3	MW disk, anti-center, inner halo
AEGIS	2°, 392	R=1600/10,000	14<V< 18	
VLT/FLAMES	0.5°, 130	R =25,000/10000	V<16.5,V < 19	GAIA-ESO survey
HERMES		R=28,000	12<V<14	
LAMOST	5°, 4000	R=1500	g < 19.5	MW anti-center/halo
4MOST	3°, 3000	R=5000		Chemistry for GAIA stars
GAIA			V < 17	
BigBOSS	7°, 5000	R ~ 4000	g < 22	???