# GALACTIC STRUCTURE AND STELLAR POPULATIONS

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Structure of our discussion

- Identified broad science themes
- Considered landscape in 2020
- Identified suite of technical details needed to define spectroscopic capabilities
- For each science theme, drilled down into specific science questions
- Began to populate big table of technical details
- Identified specific questions needing answers
- Maintained a running list of "low hanging fruit"

Discussion in a nutshell

A. Galactic structure

- What is the accretion history of the Galaxy?
- What is the shape of the dark matter halo?
- What does the population of DM subhalos look like?
- How long is the metal-poor tail?

LSST discovery space

MSTO to ~200 kpc

RR Lyrae to 400 kpc
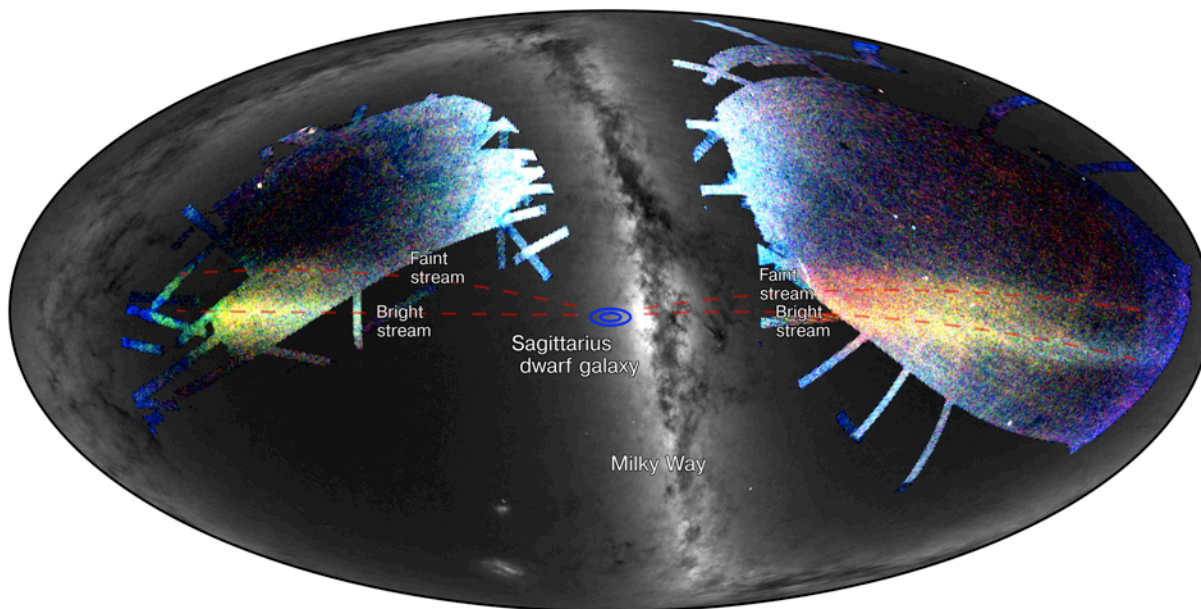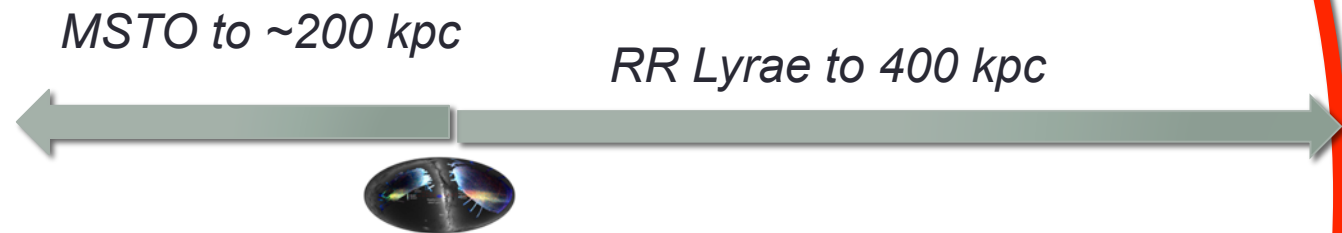
What is the accretion history of the Galaxy?

- Tracers: Giants, HB stars, subgiants, MSTO stars
- Measurements: velocities (<10 km/s accuracy)
- Abundances: [Fe/H], [α/Fe], [C/Fe], individual species
- Proper motions from GAIA and LSST
- Sample size ~10^6?

Questions, comments:
- How hot a tracer can we effectively use?
- What is the sweet spot for v_{err}?
- How to efficiently select targets?
- What different samples are needed?
- Need to push on photometric accuracy

A. Galactic structure
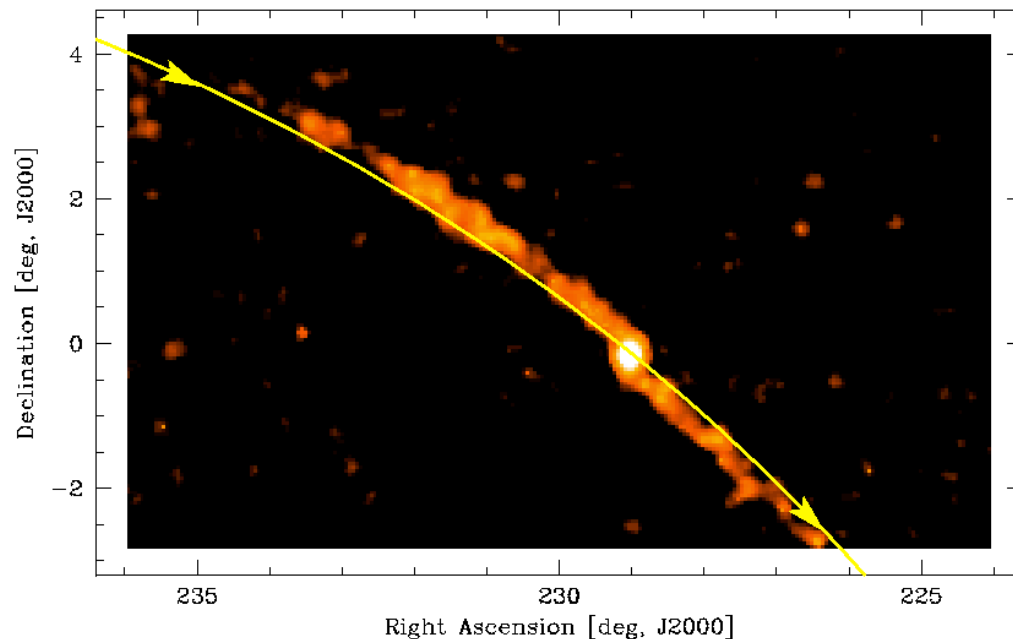
What does the population of DM subhalos look like?
DM subhalos perturb streams
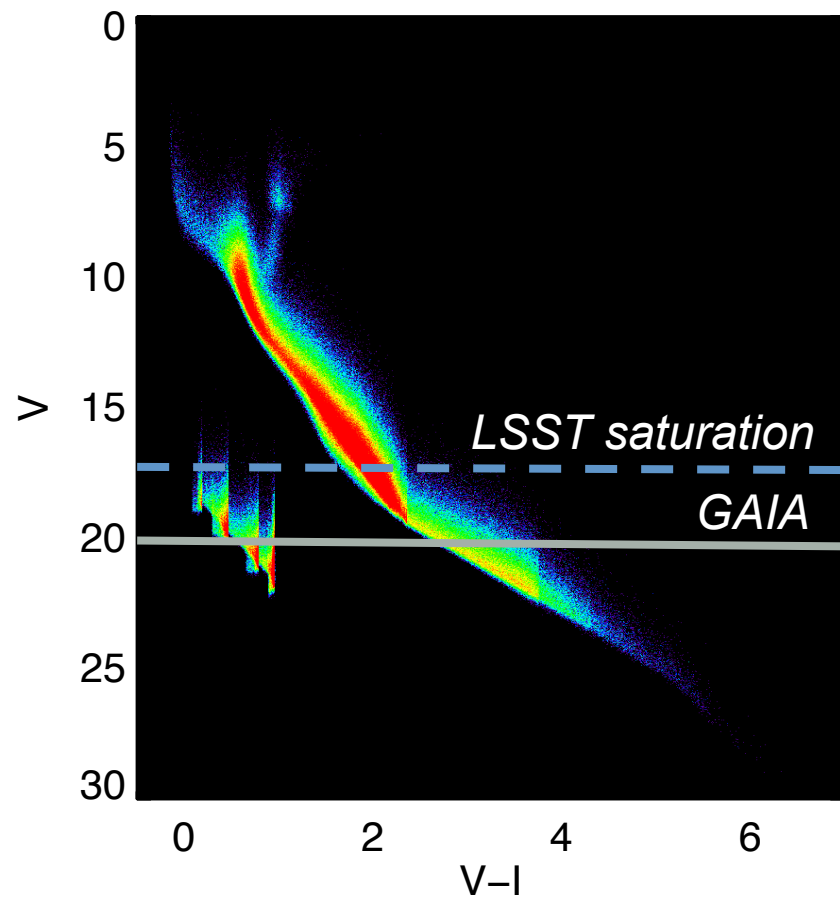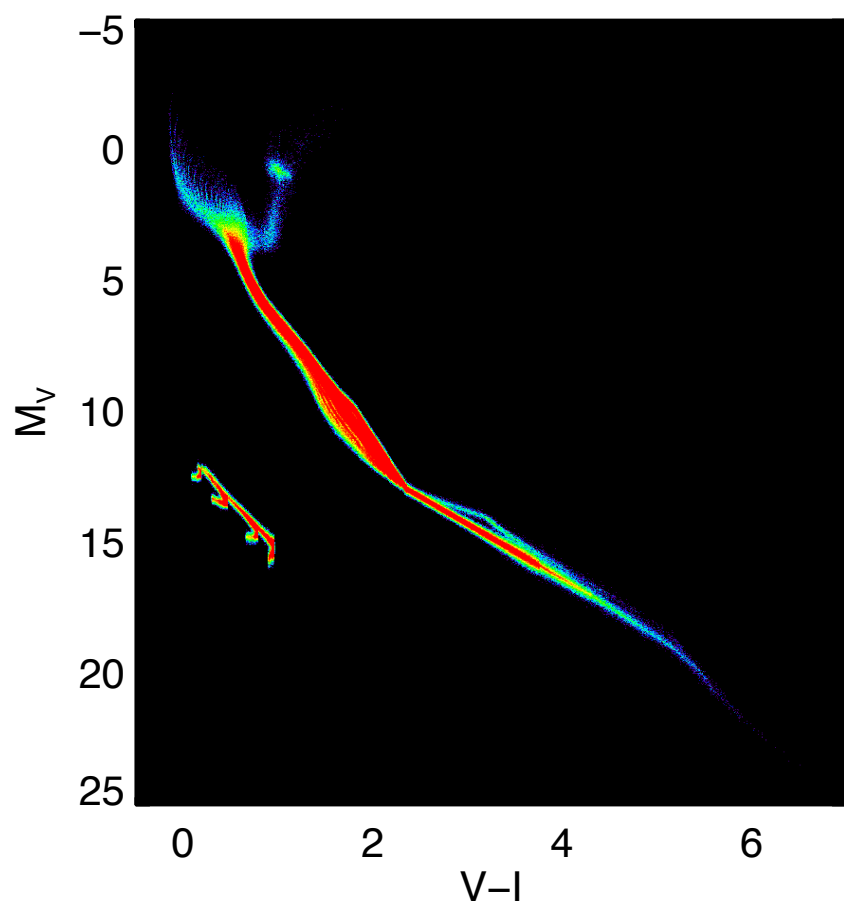Tracers: all stars in streams, colder better
Measurement: velocities <1 km/s
Need to turn sample size into magnitude distribution
Simulation?

B. Solar neighborhood

LSST: 200 pc volume, 10% parallaxes

B. Solar neighborhood

What are the masses of BDs?
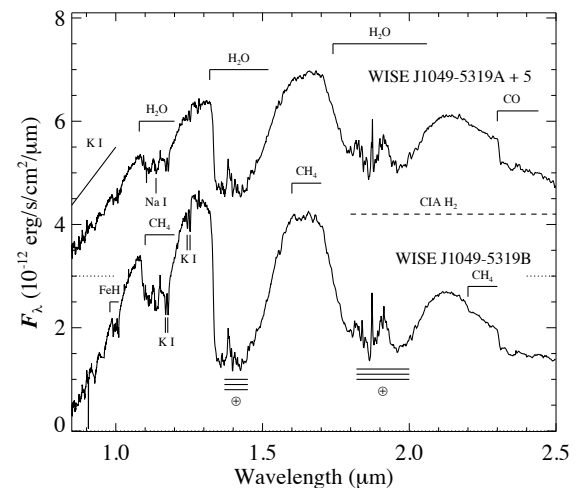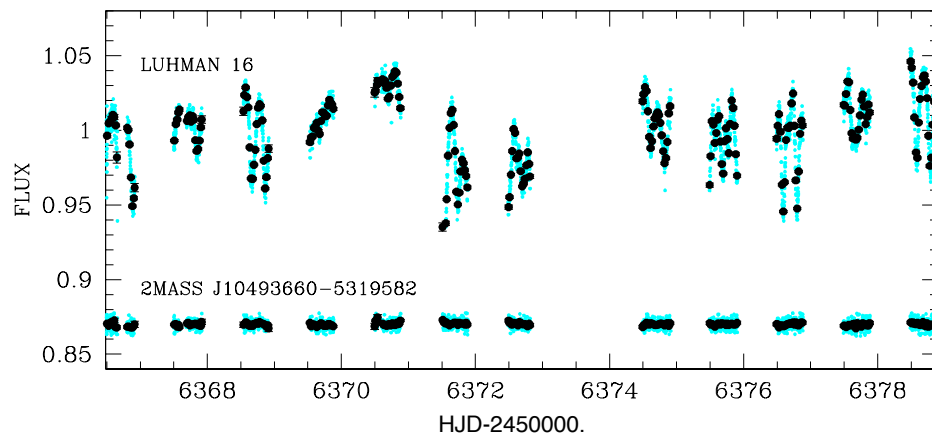 Tracers: Binary BDs
  Velocities: <50-100 m/s
  R~40-50K

Q: Can we use color as binary selector? Will have distance.

What is the nature of weather on BDs?
Measurement: linked spectral and photometric variability

C. Milky Way and local galaxy populations

- Known and unknown Star clusters

- Known and unknown dwarf galaxies
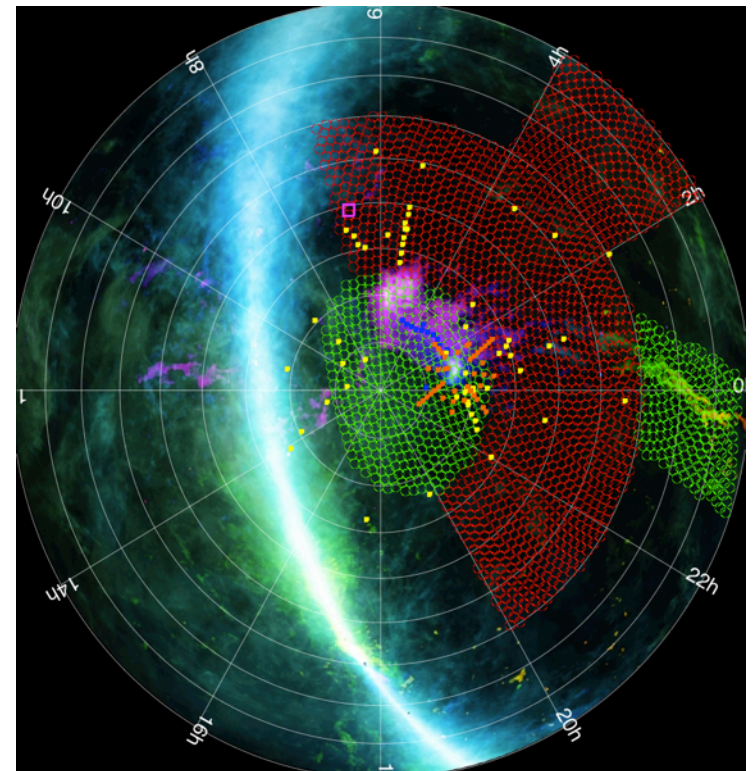
D. Extended sources

- ISM
  - Stellar classification for aid in creating dust maps

- Galactic light echoes
  - Diffuse light spectroscopy

- Microquasars
  - Spectral study of surrounding low surface brightness features

Technical capabilities discussed

- Depth
- S/N
- Wavelength
- Resolution
- Target surface density
- Survey area
- Minimum sample size
- Desired sample size
- Target selection efficiency
- # visits
- Cadence
- Data needed when?
- Other considerations: overlap with other science areas, potential capability trades, narrowband imaging as complement or replacement for spectroscopy?)

Question	Depth	S/N	λ	R	Σ_{target}	Area	Min. sample size	Desired sample	Eff	# visits	Cadence	Data volume Throughput	Co
Galaxy mass dynamics	22−25 $r\sim22$ 40 kpc (MSTO) 100 kpc (HB) 400 kpc (RGB)	5−10	optical	3000−5000	?	1000− 10,000 sq. deg.	10⁵ halo 10² thick disk	~10⁷	?	×	×	
Abundances ([Fe/H], α/Fe, C)		20	optical	2000	' ' smaller?			~10⁷					
ind. α els,		30−50	optical	5000	so much smaller?								
n-capture "all elements		50−100?	optical 3700−10⁴ 9000	20,000									
Dwarf + stream internal kinematics	?	~10	~8600 5000−9000	~10⁴									
M dwarf M.F. BD weather WDs	20−24 20−24 20−24	5−20 >10 >10	6000Å/μm 1−1.6 μm optical	2000 5000?		~18,000 sq. deg.	10⁵ ~1000	10⁶ ~10⁴?					