Large Synoptic Survey Telescope

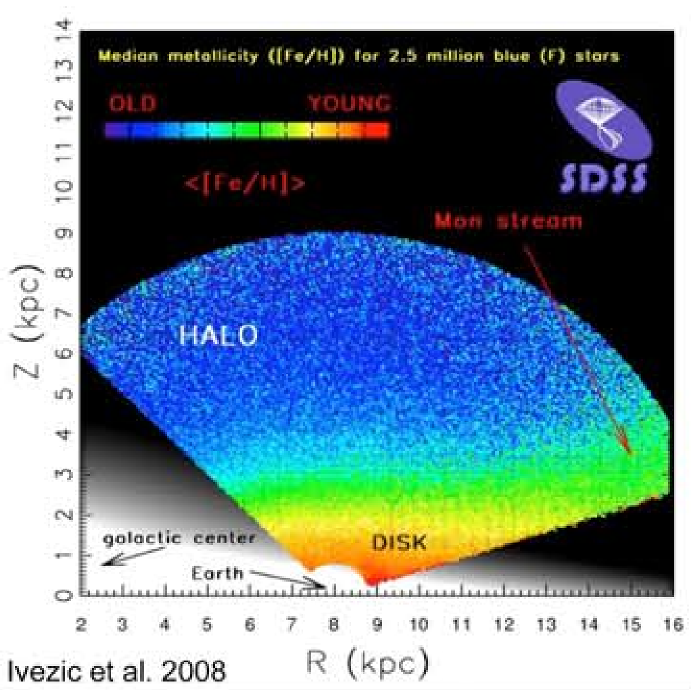
www.lsst.org

Mapping the Milky Way and Near Field Structure with LSST

J. Bullock[1], B. Willman[2], C. Grillmair[3], Z. Ivezic[4], J. Kalirai[5], J. Strader[6], LSST Milky Way and Near Field Structure Science Collaboration

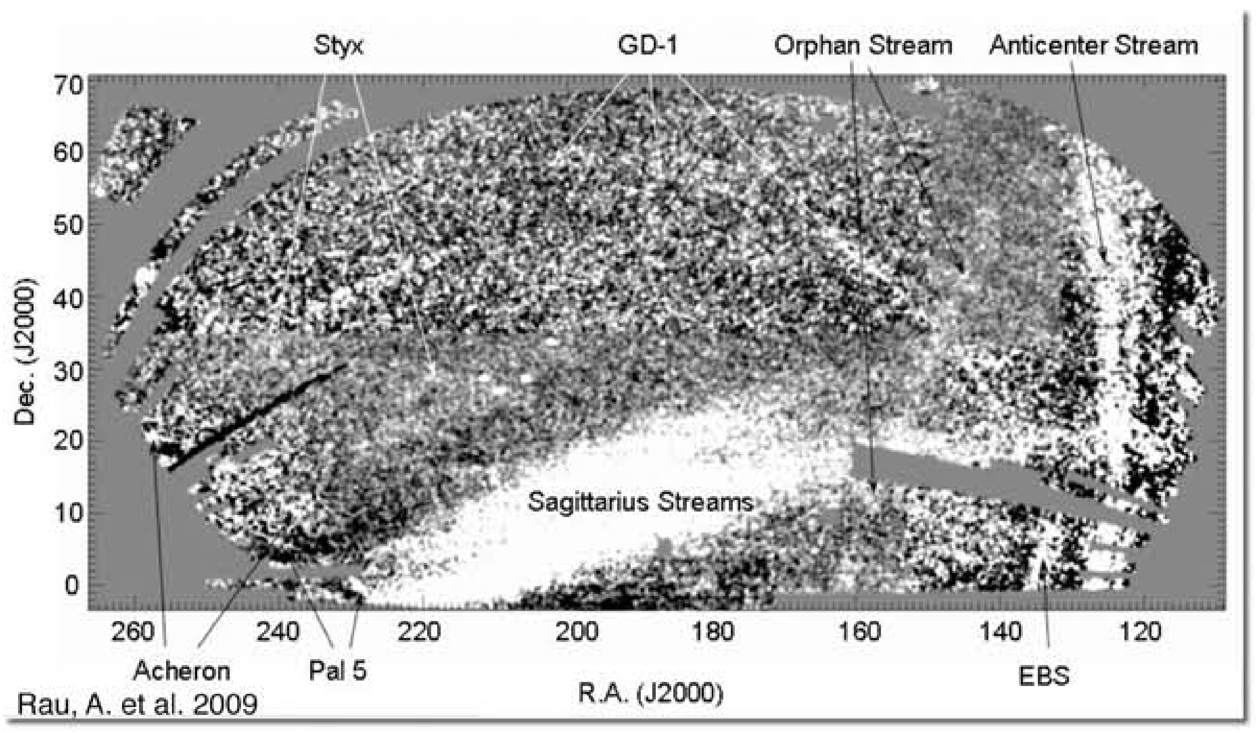
[1]UC, Irvine, [2]Haverford College, [3]Spitzer Science Center, [4]University of Washington, [5]Space Telescope Science Institute, [6]Harvard-Smithsonian CfA

Recent results from large-area surveys have drastically altered our view of the Galaxy, doubling the known population of satellite galaxies and revealing a complex, dynamical structure that is still being shaped by the infall of smaller systems. The multicolor, multi-epoch photometric map created by the LSST will provide an unprecedented means to extend our exploration of the Galaxy's structure, star formation, chemical enrichment, and accretion history on a panoramic scale. Strategic time and space sampling of each field over ten years will allow variability, proper motion and parallax measurements for objects brighter than V~24 and will permit both photometric parallaxes and chemical abundance estimates for over a billion main sequence stars to 100 kpc. New dwarf galaxies in the Local Group and other nearby groups will be revealed via over-densities in resolved stars and provide important constraints on the nature of the Dwarf Satellite problem faced by CDM cosmologies.



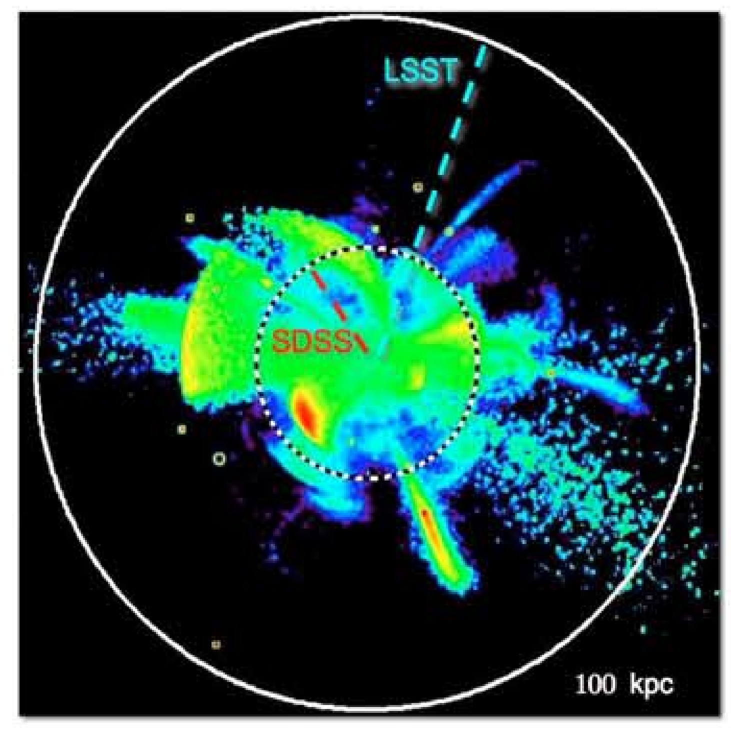
Photometric Metallicity Maps of the Galaxy

SDSS DR6 median photometric metallicity map for 2.5 million Milky Way disk stars shown in cylindrical Galactic coordinates R and Z . The gradient of the median metallicity is approximately parallel to the Z axis, except in the Monoceros stream region, as marked. This may suggests that the Monoceros stream is a disk feature as opposed to an accreted satellite stream. **LSST will extend these maps to ~100 kpc distances and open new windows on the assembly of the Milky Way.**



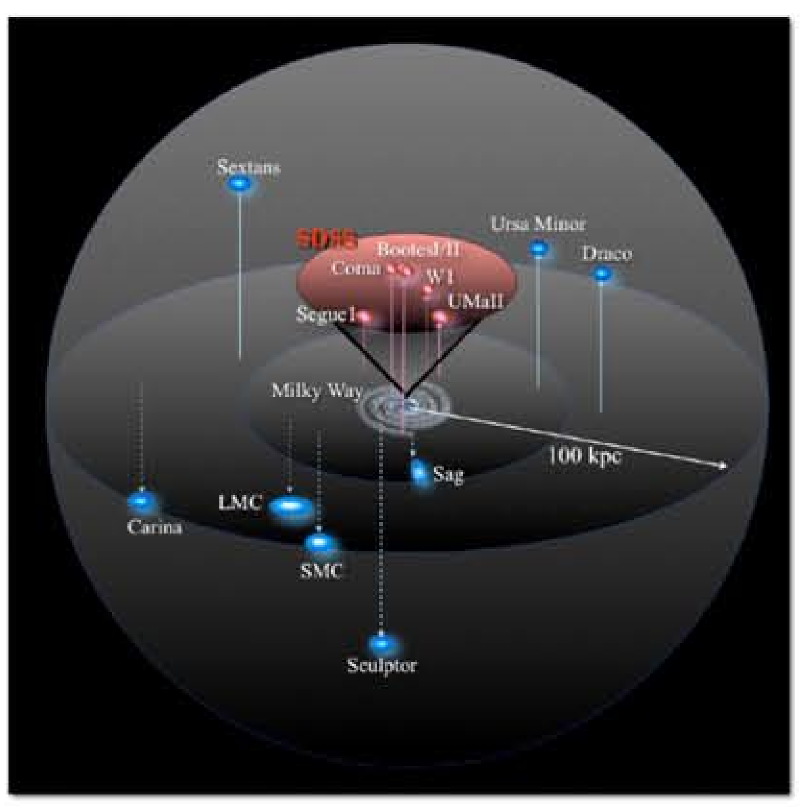
Structure of the Outer Milky Way

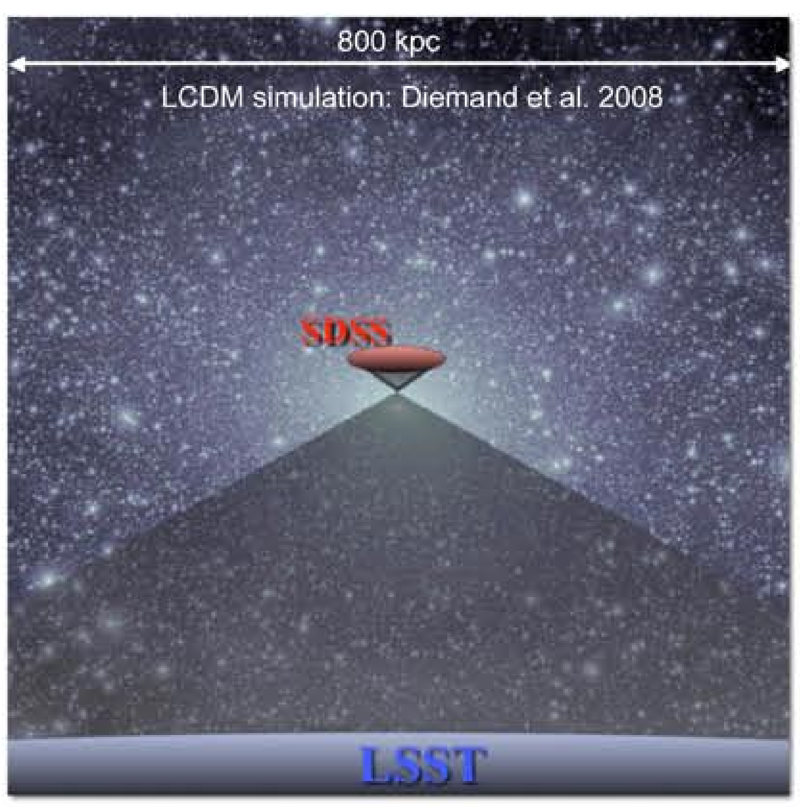
A composite, filtered surface density map of stars in the SDSS DR 5. Stars have been filtered to select stellar populations at different distances with color-magnitude sequences similar to that of the globular cluster M 13 (Grillmair 2009). Lighter shades indicate enhanced surface density. The distances of the streams range from 4 kpc for Acheron, to 9 kpc for GD-1 and the Anticenter Stream, to ~50 kpc for Sagittarius and Styx. The detection of substructures in the SDSS is effectively limited to ~50 kpc, **Similar techniques applied to the LSST dataset will enable searches out to 500 kpc**.



Expectations

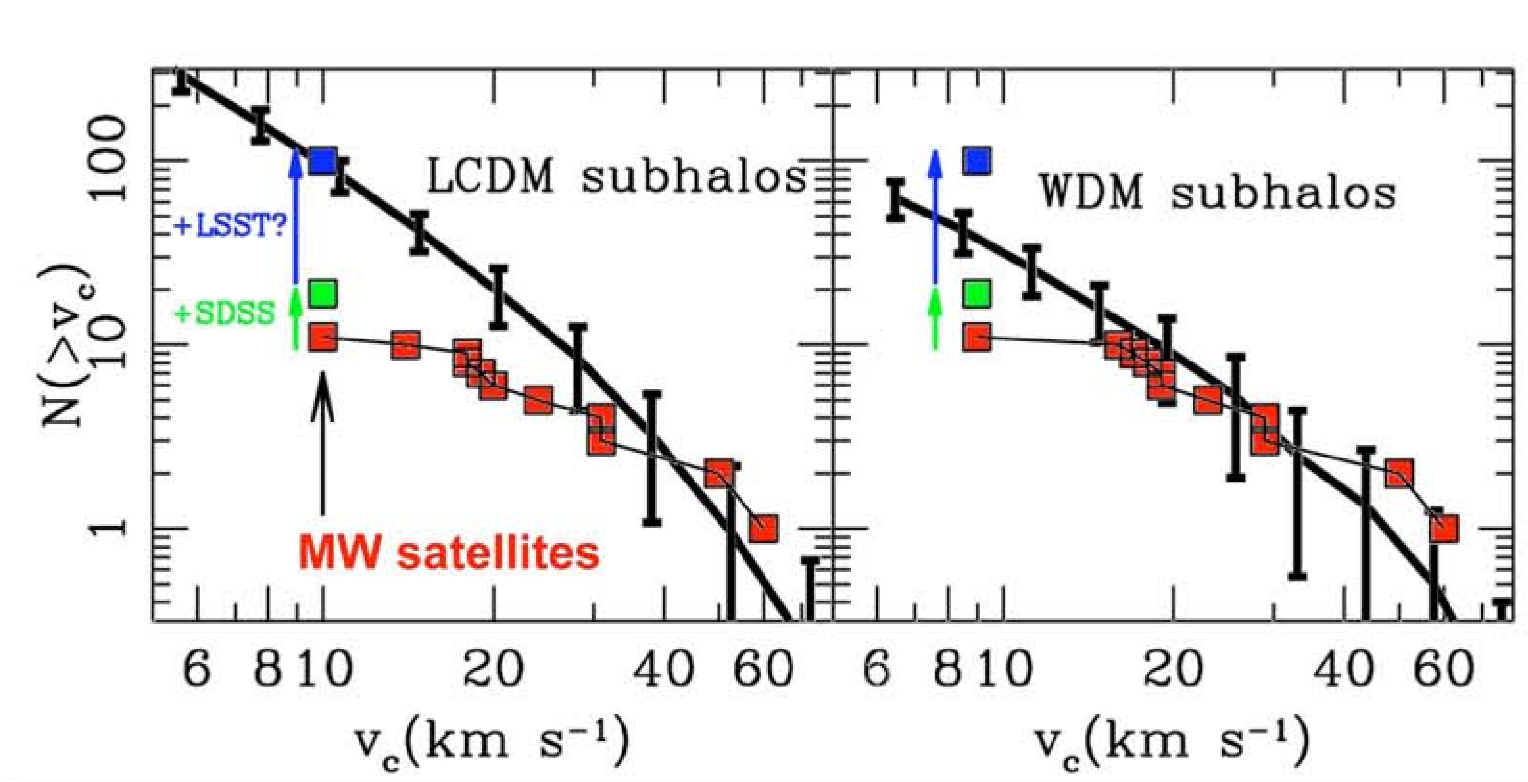
Star density multiplied by radius cubed from the stellar halo simulations of Bullock & Johnston (2005). LCDM predicts that the Milky Way should have accreted and destroyed hundreds of small dwarf galaxies in the past 10 Gyr. Overdensities of this kind have been revealed by RR Lyrae tracers to a distance of 100 kpc (Ivezic et al. 2003). **LSST will detect RR Lyrae to 400 kpc over a larger area of the sky, extending the SDSS mapping volume by more than a factor of 100.**





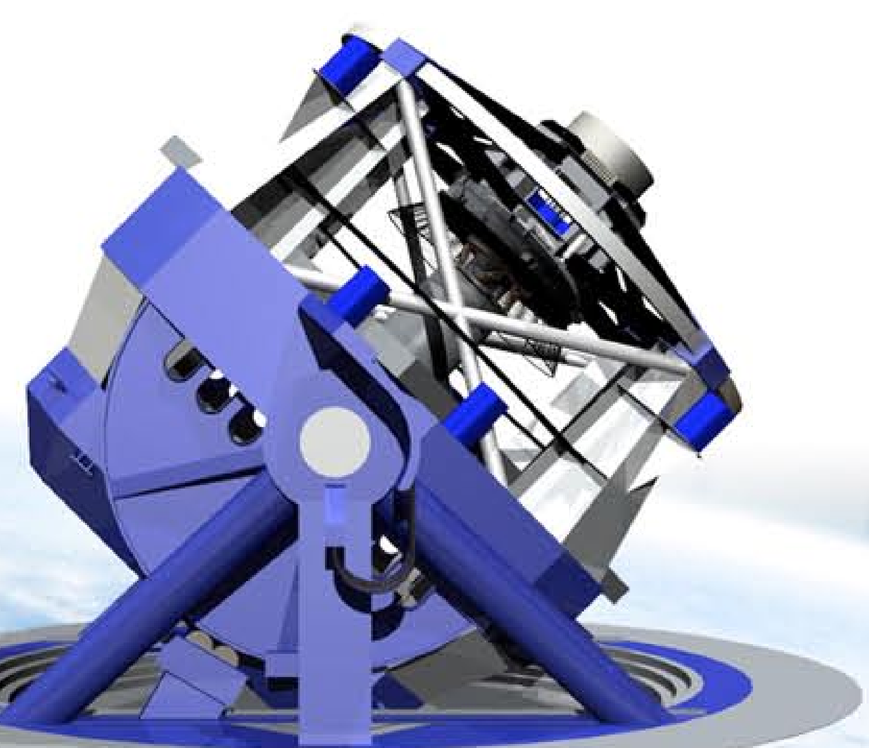
Milky Way Satellite Census within 400 kpc

The SDSS has revealed a population of ultrafaint, $L\sim10^2$ - 10^4 L_{sun} dwarf galaxies all within ~50 kpc of the Sun (Willman et al. 2005; Belokurov et al. 2007; Grillmair 2009). These objects may signal a much larger population of faint galaxies at larger distances, which fall below SDSS detection limits (Koposov et al. 2007; Walsh et al. 2009). **LSST will detect ultrafaint galaxies out ~400 kpc distances over half of the sky** (Tollerud et al. 2008).



Dwarf Satellites and the Nature of Dark Matter

A more complete census of the Milky Way satellites as provided by LSST will help elucidate the nature of the 'Missing Satellites' problem facing LCDM. The current count (green + red) is close to the Warm Dark Matter prediction and new discoveries from LSST may potentially rule out interesting Warm Dark Matter models (from Zentner & Bullock 2003).



References

Belokurov, V. et al. 2007, ApJ, 654, 897
Bullock, J. S. & Johnston, K. V. 2005, ApJ 635, 931
Diemand et al. 2008, Nature, 454, 735
Ferguson, A. M. N. et al. 2002, AJ 124, 1452
Grillmair, C. J. 2009, ApJ, in press.
Ivezic, Z. et al. 2003, astro-ph/030905
Ivezic, Z. et al. 2008, ApJ, 684, 287
Rau, A. et al. 2009, PASP, submitted
Tollerud et al., 2008, ApJ, 688, 277
Walsh, S. et al., 2008, arXiv:0807.3345
Willmann, B. et al. 2005, ApJ, 626, L85
Zentner, A. R. & Bullock, J. S. 2003, ApJ, 598, 49

LSST is a public-private partnership. Design and development activity is supported in part by the National Science Foundation. Additional funding comes from private gifts, grants to universities, and in-kind support at Department of Energy laboratories and other LSSTC Institutional Members.