Large Synoptic Survey Telescope

Mapping the Milky Way with LSST

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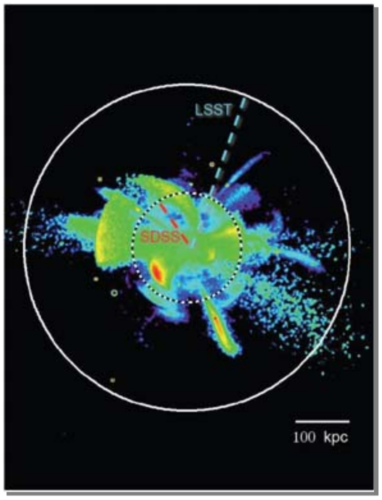
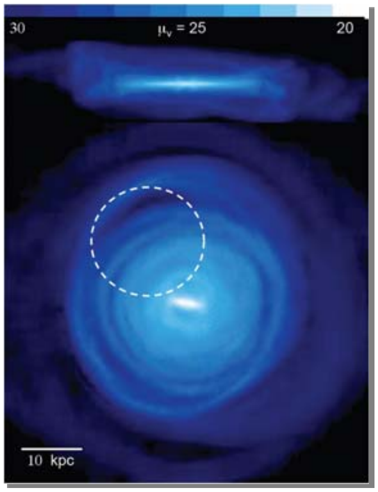
The multicolor, multi-epoch photometric map created by the LSST will provide an unprecedented means to explore the Galaxy's structure, star formation, chemical enrichment, and accretion history on a panoramic scale. Strategic time and space sampling of each field over ten years will allow variability, proper motion and parallax measurements for objects brighter than V=24, and the final map will cover half the sky to V=26.5. This combination of area, depth and time resolution will enable Galactic science from the solar neighborhood to the edge of the Milky Way's halo and well into the Local Group. The data set will provide a powerful laboratory for testing theories of galaxy formation and the small-scale predictions of CDM cosmology.



Structure of the Outer Milky Way:

Left: 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. The residue of this process survives as structure in the outer halo. Overdensities of this kind have been revealed by SDSS star count studies (e.g. Bell et al. 2007), including RR Lyrae stars to a distance of 100 kpc (Ivezic et al. 2003).

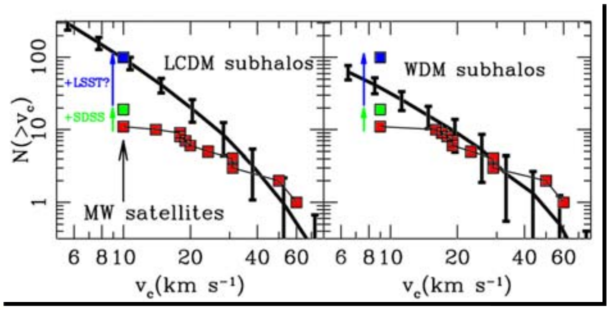
- •LSST will detect RR Lyrae to 400 kpc, extending the SDSS mapping area by a factor of 50. This will provide an important test of the small-scale accretion history of the Galaxy and a test of LCDM.
- •RR Lyrae maps and related main sequence star counts with kinematics will allow precise measurements of the Milky Way dark halo potential.



Structure of the Inner Milky Way:

Left: Surface brightness maps from a disk galaxy simulation by Kazantzidis et al. (2007). Faint, complex structures arise from its hierarchical merging history. Star count maps offer a unique means to constrain theories by revealing detailed features. The first generation of studies have found similar structures in the Milky Way and M31 (Newberg et al. 2002, Ferguson et al. 2002, Juric et al. 2005).

- •LSST will provide photometric parallaxes for over a billion main sequence stars to 100 kpc and map the Galaxy's surroundings to high precision.
- •Time series data will provide proper motions at ~10 km/s at 10 kpc (dashed circle) and chemical abundance estimates for main sequence stars. Multi-dimensional maps will produce a phase-space record of the Galaxy's formation history.



Dwarf Satellites and the Nature of Dark Matter:

Left: Predictions for the dark subhalo velocity function in Milky-Way size halos for LCDM (σ_8=0.83, left panel) and WDM (right panel) from Zentner & Bullock (2003). Red squares show the cumulative dwarf satellite count prior to SDSS. The green square includes 11 new low-surface brightness dwarf spheroidals discovered using star counts in SDSS maps (e.g. Willmann et al. 2005, Belokurov et al. 2007).

- •Fainter star count maps over more sky will allow LSST to reveal new dwarfs as stellar overdensities. This possibility is represented by the blue square in the figures.
- •A more complete census of the Milky Way satellites will help elucidate the nature of the dwarf satellite problem facing CDM. The current count (green) is close to the WDM prediction and new discoveries may potentially rule out interesting WDM models.

References:

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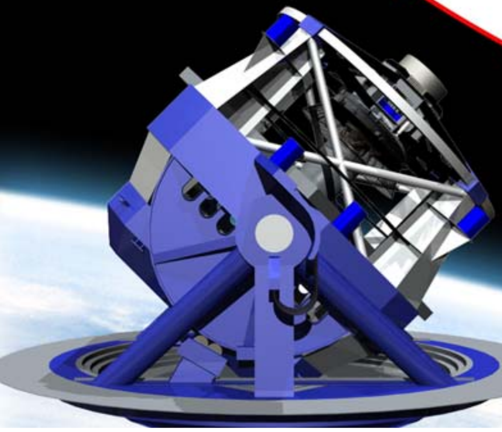

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