Coherent Satellite Planes around Cosmological Milky Way Hydrodynamic Simulations

Sheehan H Ahmed & Dr. Alyson Brooks

Hammer-Aitoff Projections

**Cyan** = Subhalo Position

**Magenta** = Subhalo Angular Momentum Vector

- DM only
- **DM only** + baryons

- Planes exist
- Similar in DM and DM + baryons
- Some with coherent rotation
Examining the Evolving Properties of Dwarf Galaxies

Kenza S. Arraki

$10^4 M_\odot < M_{\text{star}} < 10^5 M_\odot$

$10^5 M_\odot < M_{\text{star}} < 10^6 M_\odot$

$10^6 M_\odot < M_{\text{star}} < 10^7 M_\odot$

$M_{\text{star}} > 10^7 M_\odot$
Spatial segregation in star cluster merger remnants
Sideways Stellar Motions Suggest Shell in Milky Way Halo

Deason, van der Marel, Guhathakurta et al. 2013
Signatures of the M31-M32 Galactic Collision
Marion Dierickx, Avi Loeb (Harvard CfA) and Laura Blecha (U. Maryland) 2014 ApJL 788:L36

Andromeda’s nested ring-like structure, and M32’s unusual compact elliptical morphology

successfully replicated with the first self-consistent model of M32’s passage through Andromeda’s disk.

LG Astrostatistics, May 2015
A Likelihood-Based Search for Milky Way Satellite Galaxies

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**Likelihood Technique**

Assume that a stellar catalog represents a Poisson realization of (1) a field contribution including foreground stars and misclassified galaxies, and (2) a putative satellite galaxy

- Build an empirical model for the local field contribution
- Model the spatial distribution of satellite stars with an elliptical density kernel (Figure 2a)
- Model the photometric distribution of satellite stars with a metal-poor isochrone weighted by a stellar initial mass function (Figure 2b)
- Use the survey depth to predict the number of observable stars (Figure 2c)
- Scan the survey area maximizing the Poisson likelihood with respect to satellite model parameters
- Calculate statistical significance of putative satellites with a likelihood ratio test

The likelihood procedure results in a probability that each star is a member of the putative satellite galaxy (Figure 3)

**Figure 2:** The model for a satellite galaxy is composed of a spatial kernel (left) and a stellar isochrone weighted by an initial mass function (center). The predicted number of observable stars incorporates spatial variations in the depth of the survey (right).

**Figure 3:** Photometric membership probabilities for stars associated with the Reticulum II galaxy.
Can Self-Interacting Dark Matter... Solve problems in the Local Volume?

We run high-resolution ($\epsilon = 28$ pc) simulations of dwarf galaxies to find out!
Constraining the distribution of dark matter in dwarf spheroidal galaxies with stellar tidal streams

Raphaël Errani, Jorge Peñarrubia & Giuseppe Tormen (Padova, Edinburgh)

- how is DM distributed on small galactic scales – are dSphs cuspy or cored?
- using high-resolution $N$-body simulations ($2 \cdot 10^7$ particles per dSph), we study the tidal disruption of dSph galaxies and the formation and evolution of tidal streams
- we show how the mass distribution of dSphs determines morphology and kinematics of the associated tidal streams
- we propose a new method to distinguish cuspy from cored dSphs by observing both the dSph and the tidal stream