What might WINGS See?
(WFIRST Nearby Galaxies Survey)
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Abstract

Three aims of a WINGS study of stellar halos are: (i) to look at the global properties of the halos (e.g. radial profile and total content); (ii) to find and interpret structures that are signatures of accretion histories (including luminosity functions, merger rates and orbits); (iii) to find features at widest possible separations in constrain the distribution of dark matter. For all of the above purposes, the halos should be observed to the greatest radial extent possible. The extent to which this is possible or interesting will depend on expected densities of the stellar halos as well as contamination by background galaxies at faint magnitudes. This study “observes” the Bullock/Johnston stellar halo models as a guide for expectations.

Methods

• The stellar halo models used are made from superposed N-body simulations of individual satellite disruption events (Bullock & Johnston 2005) with the particles painted with stellar populations (Robertson et al 2005, Font et al 2006). Accretion histories are drawn from LCDM cosmology. Satellite properties are chosen such that any surviving satellites’ structures and populations look like Local Group dwarfs.

• Mock stellar halo catalogues for our analyses are generated from the full stellar halo models using Galaxia (Sharma et al 2013). Stars are generated for each halo out to radial separations of 300 Kpc.

• For this poster, all the halos are observed at distance D=4Mpc from one assumed line-of-sight and keeping only stars brighter than apparent magnitude $m_{158}=27.12$, (slightly less than 1 magnitude brighter than the horizontal branch).

• Our “observed” models each contain of order several million stars.

• Statistical analysis of the frequency, significance and scales of features at different projected separations.

• How are their distributions related to accretion histories, luminosity functions and orbit distributions?

• How can WINGS be designed (integration time, angular and radial coverage of each galaxy, number and scales of galaxies observed) to maximize its impact?

Acknowledgements

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References


Summary of results for all 11 halos

Figure 3: Map of Xbox (≈ fractional fluctuations around the mean star counts at each radius). Adapting a minimum of Xbox=5 clearly isolated features at large radius. All three features identified with Xbox > 5 have > 99% of their stars coming from a single satellite. $\Rightarrow$ Features at large separation will be particularly useful potential signal.

Further work

• How can WINGS be designed (integration time, angular and radial coverage of each galaxy, number and scales of galaxies observed) to maximize its impact?

• How are these observed properties of individual features related to properties of the satellites that formed them?

• How are their distributions related to accretion histories, luminosity functions and orbit distributions?

• Statistical analysis of the frequency, significance and scales of features at different projected separations.

Figure 1: Projected star count map for Halo 8. The map is richly structured, in particular at projected separations greater than 100kpc.

Figure 2: Fractional star counts in each box are color coded by the most common accretion time of stars in each box. The features highlighted in Figure 1 correspond to more recently accreted objects.

Figure 4: Maximum Xbox values for all 11 halos. While halo 8 has particularly spectacular results, all 11 halos show interesting and significant structure filling several percent of each annulus at separations out to 150-200kpc.

The map is richly structured, in particular at projected separations greater than 100kpc. It will be useful for WFIRST to map stellar halos to large projected separations where distinct features can be identified and interpreted in terms of accretion events.

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