Nearby Galaxies Are Great for Astrophysics

- Detailed view and context simultaneously
- Sensitive to galaxy evolution and cosmology
- Anchor our knowledge for interpretation of more distant universe
- Large samples - Subdivide sample for specific goals
- Cover a wide range of galaxy properties
Huge Potential Data Set

![Graphs showing data distribution for HST and WFIRST]
## Projects and Lead Co-Is

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**Deputy PI:** Dalcanton (U. Wash.)  
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Collaborators

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Stellar Halos with WFIRST

M101: 7.4 Mpc

WFC3-IR-PID: 12298

1.9 kpc

0.9 kpc

130 kpc

Representative Ground-Based

Representative Space-Based

Williams: WINGS SIT June 2017
Stellar Halo Structures

Number, luminosity, shape of streams → Types, timing and orbits of galaxies accreted.
Disrupted streams → Small-scale dark matter halos.
Dwarf Satellites

Lots of dark, sub-galactic halo satellites predicted
Globular Clusters

- Old: Probe early epochs of galaxy assembly and halo formation
- WFIRST partially resolves >90% of GCs in galaxies <10 Mpc
- Individual RGB stars can give information on metallicity
- Spectroscopy Targets

Virgo intracluster globulars
(Williams et al. 2007)
Stellar Populations with WFIRST

Huge increase in sampling of short-lived, high-luminosity phases
Star Formation Histories

Wide Field Coverage Probes Trends with Radius
Large Sample Probes Trends with Galaxy Mass.
Lowest masses sensitive to reionization.

Andrew Graus, speaking later!
Dust and Population Maps

- RGB Width ➔ Dust Absorption
- RC/RGB Color ➔ Metallicity
- Main Sequence ➔ Star Formation Rate
GO-program synergy: Resolved Population Needs

- Field of View (context and more stars)
- Wavelength coverage (colors)
- Resolution (depth and background removal)
WFIRST Imaging of Bullock & Johnston Simulations

Halo populations by Robyn Sanderson
Accreted Halo Metallicity and Accretion History

D’Souza & Bell, 2017; from Illustris simulations
Production of simulated halos to test structure recovery

See poster by Sol Courtney

Also the Galactic halo poster by Amy Secunda
Recovering Populations

$\Delta [\text{Fe/H}] = 0.5$ dex

Z087 and H158 Colors
Age/Metallicity recovery

See poster by Meredith Durbin
Simulating Observations
Space Telescope Image Product Simulator (STIPS)
STIPS simulations
Simulating M83 (~4 Mpc)

7 Field UVIS Mosaic — One WFIRST 4k x 4k detector
Simulating M83

7 Field UVIS Mosaic —- One WFIRST 4k x 4k detector

Williams: WINGS SIT June 2017
STIPS simulations
F606W as Blue Filter
F606W as Blue Filter
F606W as Blue Filter
F606W as Blue Filter
Disk and Halo
Disk and Halo

Metal-poor RGB
Subaru HSC
Bell et al. (in prep)
Simulating Halo Images
Simulating Halo images

Background: CANDELS-based catalogs

Stars: Galaxia catalogs of simulations

Blue = Z087
Red = H158
Simulating Halo images

Background: CANDELS-based catalogs
Stars: Galaxia catalogs of simulations

Blue = Z087  Red = H158

Stars in a Halo at 5 Mpc
Simulating Halo images

Background: CANDELS-based catalogs

Stars: Galaxia catalogs of simulations

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Red = H158
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Testing WFIRST with Nearby Galaxies

- Continue STIPS development. Complete end-to-end simulations
- Simulate observation of real galaxies, simulated halos, simulated companions
- Run photometry, S/G separation, and model fitting
- Try different filter, dither precision, and PSF possibilities
- Optimize science (density feature recovery, population recovery) given the trades
Next up: M51 (~8 Mpc)
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Watkins et al. 2015