Resolved Stellar populations in the Local Group with MSE

Nicolas Martin
(Observatoire de Strasbourg)
Dwarf galaxies

Milky Way

M31 + Local Group
Milky Way dwarf galaxies

adapted from Walker (2013)
The faintest dwarf galaxies?

Laevens, Martin et al. (2015)

→ best hope for (indirect) dark matter detection/constraints but…
The faintest MW satellites...

Walker et al. (2015)

\[ \sigma \sim 3 \text{ km/s but...} \]
Challenges

- Velocity dispersion from handful of stars
  - need depth
- Questions on velocity accuracy/repeatability
  - need stability
- No clear assessment of binaries
  - need systematic temporal spectroscopic campaigns
- No dedicated global study (≠ instruments, technique,…)  
  - need systematic survey
- No obvious improvement in next 10 years → *Need MSE*
Brighter dwarf galaxies
Constraining the low end of galaxy formation

Carina, $\sim 5 \times 10^5 \, \text{L}_\odot$

10-year endeavor for one galaxy
Need large field of view, many fibers
to hunt for few extra-tidal stars

Muñoz et al. (2006)

Ugur et al. (2015)
PAAndAS

McConnachie et al. (2009)
Martin et al. (2013)
Ibata et al. (2014)
Different causes produce different halos

Johnston et al. (2008)

\[ \mu \text{ (mag/arcsec}^2) \]

| 38 | 23 |

\[ [\text{Fe/H}] \]

| -2.0 | -0.5 |

\[ [\alpha /\text{Fe}] \]

| -0.1 | +0.2 |

\[ v_r \text{ (km/s)} \]

| -200 | +200 |

\[ \sigma \text{ (km/s)} \]

| 0 | +150 |

At the moment:

• central parts of one galaxy (MW)
• one galaxy with poor information (M31)

variance?

different accretion histories?

outer halo?
A complete survey of M31’s surroundings?

Projected density of RGB candidates around M31 [ 0.5<(g−i)<2.0 ]
MSE prospects

Figure 2: Aitoff–Hammer projection of the M31 satellites (filled circles) as seen from the center of the Andromeda galaxy (Ibata et al. 2013). The background image represents the probability density function of the poles of the plane (the colour scale on the right shows the relative probability of the poles). A narrow peak at ($l_{M31} = 100.9\degree \pm 0.9\degree, b_{M31} = 38.2\degree \pm 1.4\degree$) highlights the small uncertainty in the best-fit plane. The solid red line represents the plane corresponding to this best pole location.

Figure 3: Left: A PAndAS color magnitude diagram for And XXV, the low mass dSph that resides in Andromeda's plane of satellites. Black points represent all stars within 2$r_h$ (6 arcmin) radius of And XXV, while red points represent all RGB stars (totaling 236 stars) that could be targeted with our proposed observations. We have also indicated the resulting S:N of the DEIMOS spectra as a function of $i$ band magnitude as calculated with the DEIMOS ETC.

Right: The spatial distribution of the high probability targets indicated in the left hand panel. The DEIMOS FOV is also plotted for a scale reference.

DEIMOS In observing

→ velocities
→ $[\text{Fe/H}]$
→ $[\alpha/\text{Fe}]$
Full chemodynamical decomposition of M31 halo!
Resolved stellar pops in the LG with MSE

- Dwarf galaxies:
  - chemical decomposition (substructures, formation, …)
  - dark matter content
    - constraints/detection of indirect dark matter inihilation
    - dark matter profile (cups? core?)
- Andromeda:
  - chemical decomposition of M31 halo
  - extent of halo
  - kinematics