HSTPROMO

Hubble Space Telescope PROper MOtion Collaboration
van der Marel, Anderson, Bellini, Besla, Bianchini, Boylan-Kolchin, Chanamé, Deason, Do, Guhathakurta, Kallivayalil, Lennon, Massari, Meyer, Platais, Sabbi, Sohn, Soto, Trenti, Watkins

- globular clusters
- young star clusters
- Local Group galaxies (M31, dSphs, LMC/SMC)
- stars and stellar streams in the MW halo
- AGN black hole jets

http://www.stsci.edu/~marel/hstpromo.html
catalogues

HST proper motions for 22 Milky Way globular clusters
(with more coming soon)
Bellini+ 2014

- 1.4 million stars (datasets ~3k to ~300k each)
- few km/s accuracy
- different environments
- different dynamical states
- multiple populations
- mass segregation / energy equipartition
dispersion profiles

NGC 2808

\[ \sigma \text{ [mas/yr]} \]

\[ R \text{ [arcsec]} \]

\[ \text{fit} \]
\[ \frac{1}{10} R_{\text{half}} \]
\[ R_{\text{core}} \]
\[ R_{\text{half}} \]

Watkins+ 2015
anisotropy profiles

\[
\frac{\sigma_t}{\sigma_r} \quad \text{vs.} \quad R \quad \text{[arcsec]}
\]

- Fit
- \( \frac{1}{10} R_{\text{half}} \)
- \( R_{\text{core}} \)
- \( R_{\text{half}} \)

NGC 2808

- Tangential
- Isotropic
- Radial

Watkins+ 2015
anisotropy and relaxation time
dispersion profiles

NGC 2808

Watkins+ 2015
distances

line-of-sight velocities

physical distance

time

proper motions

angular distance

time

Watkins+ in prep
distances

\( \sigma \) [km/s] vs. \( R \) [arcsec] for NGC 2808. Model fit line-of-sight velocities and proper motions are shown. The distance is determined as 9.45\(+0.13\)\(-0.15\) kpc. Watkins+ in prep.
distances

NGC 5904

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

proper motions
line-of-sight velocities

\[ 7.79^{+0.47}_{-0.61} \text{ kpc} \]

model fit

Watkins+ in prep
distances

\begin{align*}
\frac{d_{\text{our}} - d_{\text{Harris}}}{d_{\text{Harris}}} & \\
\text{photometric vs dynamical distances}
\end{align*}

\(-1.7 \pm 1.9\%\)
distances & M/Ls

population synthesis vs dynamical M/Ls

Watkins+ in prep
Gaia?

• not ideal for faint stars and crowded regions
• but great for **bright** stars and **outer** regions

• **absolute** proper motions
  • global motions
  • rotation

• great **complement** to HST studies
proper motions are awesome

HST PMs for 22 Milky Way globular clusters

understand anisotropy profiles

\[ \sigma_r/\sigma_t \]

+LOS → distances

more to come....