Calibrating the IR Surface Brightness Fluctuation Distance Scale Using HST WFC3

Brigham S. French,1 Joseph B. Jensen,1 John P. Blakeslee,2 Nathan Boyer,1 and Victoria Trevino1
1Utah Valley University, Orem, Utah; 2Dominion Astrophysical Observatory, Canada

ABSTRACT:
We have calculated surface brightness fluctuation (SBF) magnitudes for 14 early-type galaxies in the Fornax and Virgo clusters using the F160W (H-band) filter of the Wide Field Camera 3 (WFC3/IR). SBF is a method for determining galaxy distances, and fluctuations in the near-IR are ten times brighter than at optical wavelengths, making them measurable in much more distant galaxies. We calibrated the absolute fluctuation magnitude (M_160) as a function of galaxy color (g-z) and compared the results using different image processing techniques. This calibration enables SBF distance measurements out to 150 Mpc using the Hubble Space Telescope WFC3/IR, and reveals stellar population differences in the target galaxies.

SBF PROCEDURE:
- Obtained processed individual images from HST archive
- Images combined using integer pixel shift
- Masked out bright objects and defects
- Subtracted sky
- Measured and masked globular clusters and background galaxies
- Fit and subtracted the galaxy
- Measured Point Spread Function (PSF)
- Computed residual image
- Measured SBF amplitude by fitting the PSF power spectrum
- Calculated S/N and uncertainty
- Computed absolute fluctuation magnitude (M_160) using optical SBF distances from Blakeslee 2009.

Conclusions: The M_160 calibration for redder giant elliptical galaxies is consistent with old solar-metallicity model populations; bluer ellipticals have brighter fluctuations and younger stellar populations. The bluer dwarf galaxies have fainter fluctuations, consistent with stellar population models with lower metallicity. In the future we will compare both F110W (J) and F160W (H) SBF measurements to stellar population models to determine ages and metallicities of the galaxies. This calibration demonstrates that WFC3/IR F160W SBF measurements can reach 200 Mpc in one orbit.

References

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