The Next Generation Fornax Survey census of Baryonic Structures: their Formation and Assembly in a nearby Cluster Environment

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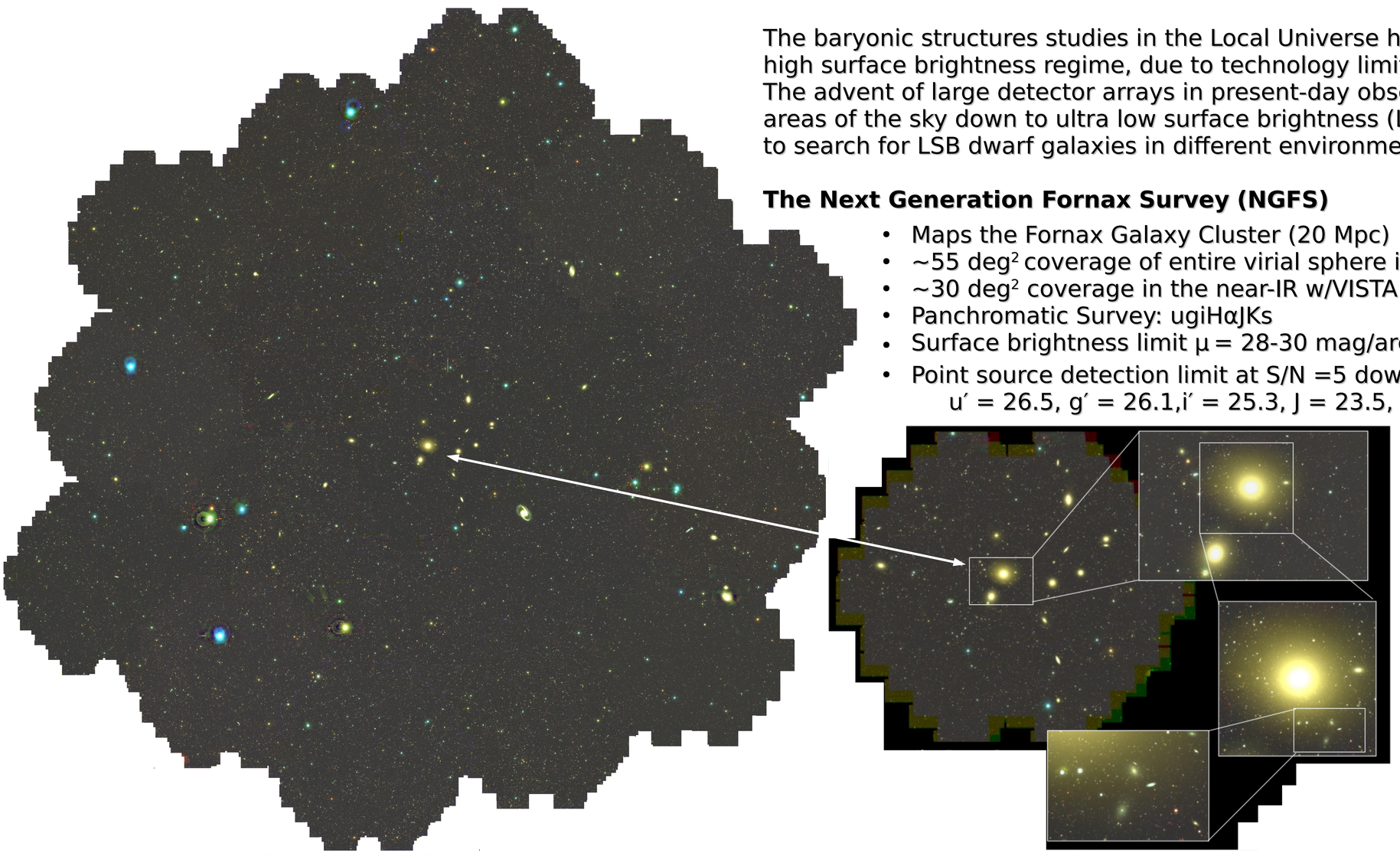
The baryonic structures studies in the Local Universe had been centered until a decade ago in the high surface brightness regime, due to technology limitations.
The advent of large detector arrays in present-day observatories has made possible to survey large areas of the sky down to ultra low surface brightness (LSB) levels, providing the exciting opportunity to search for LSB dwarf galaxies in different environments.

The Next Generation Fornax Survey (NGFS)

- Maps the Fornax Galaxy Cluster (20 Mpc)
- ~55 deg^2 coverage of entire virial sphere in the optical w/DECam (19 tiles)
- ~30 deg^2 coverage in the near-IR w/VISTA
- Panchromatic Survey: ugiHαJKs
- Surface brightness limit μ = 28-30 mag/arcsec^2 (i-band)
- Point source detection limit at S/N =5 down to:
  u′ = 26.5, g′ = 26.1,i′ = 25.3, J = 23.5, Ks=24.1 in AB mag.



Goal: detect all baryonic structures in a dense cluster environment, including giant and dwarf galaxies, nuclear star clusters (NSCs), ultra compact dwarf galaxies (UCDs) and Globular clusters (GCs).

Fig. 1: *Left panel*: NGFS DECam RGB (ugi) footprint composed of 19 tiles (~55deg^2 ,Rvir). *Right panel:* Zoom-in into the central tile, the densest region of the Fornax Cluster, where its cD galaxy NGC 1399 is located. A deeper zoom-in around its surroundings shows an example of the depth of the survey.

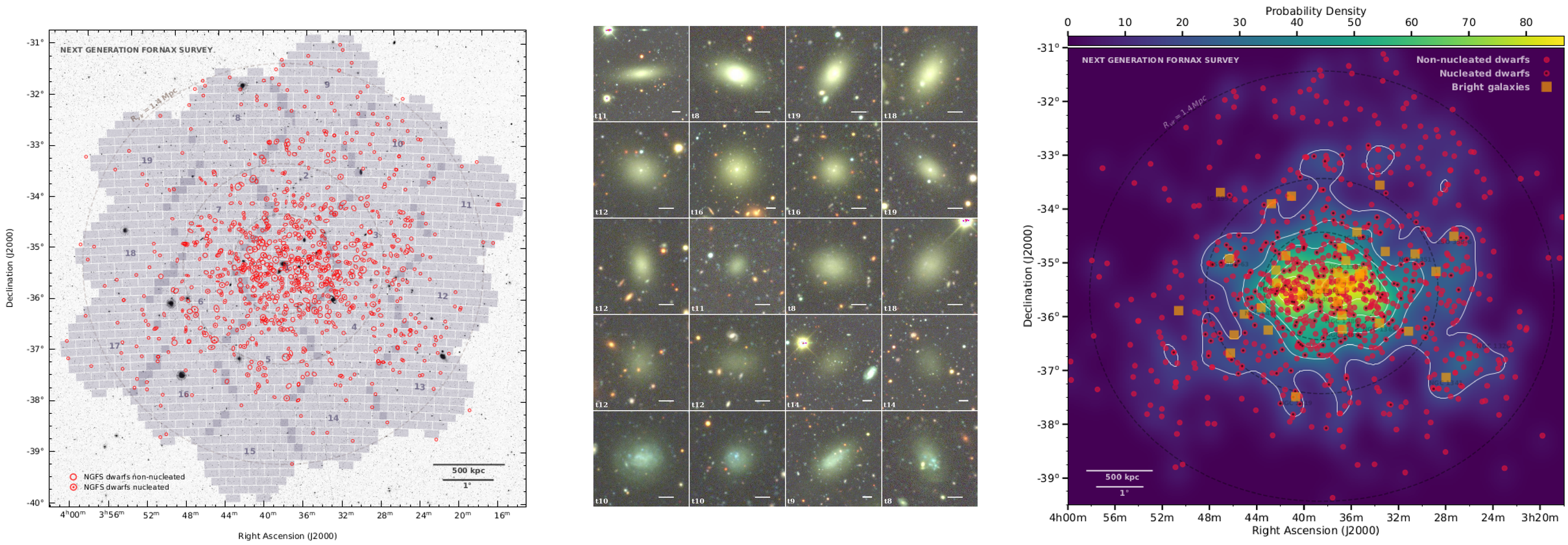


Fig. 2: *(preliminary results)* ***Left panel***: NGFS DECam footprint with the spatial distribution of the dwarf candidates that we have selected by Visual Inspection through the RGB images and by automated methods (Computer Vision and Machine Learning). The final list is still work in progress. ***Middle panel:*** Sample of dwarf galaxies in the Fornax area, from top to bottom: dE, dSph nucleated, dSph non-nucleated, ultra faint dwarfs, and dwarfs in transition (w/SF knots). ***Right Panel:*** Projected dwarf galaxy surface number density distribution shown by the color shading, computed within a grid size, and show as 2D histogram smoothed with Lanczos interpolation. A non-parametric kernel density estimate was done using a Gaussian kernel of 0°.25 bandwidth and show resulting curves of iso-density contours by white-scaled thin solid lines.

The number of dwarfs candidates in Fornax's virial sphere rises to ~800, and adding the bright galaxies to the list, we will have ~1000 galaxies to study in detail in the area.

GEMINI facilities for follow-up

An interesting line of research for follow-up is the evolution over cosmic times of nucleated and non-nucleated dwarfs. Long-slit spectra with the GMOS spectrograph at Gemini South can help us with this.

Fig. 3 shows preliminary results from GMOS-S longslit spectra of nine nucleated dwarf elliptical galaxies in Fornax. Lick absorption-line index measurements show that the nuclei (green points) appear to be systematically a few Gyr younger than the stars in the bodies of the galaxies (magenta points). A larger sample covering the full area of the Fornax Cluster (Fig. 1) would provide better statistics and important clues about the formation timescales of dwarf elliptical galaxies and their nuclei, and the connections to ultra-compact dwarf galaxies.

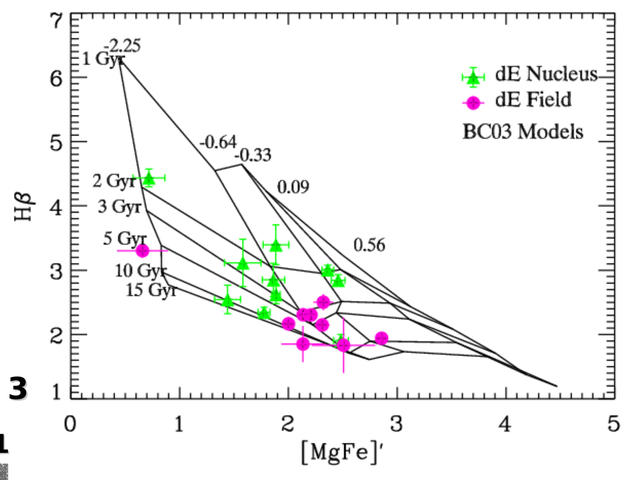
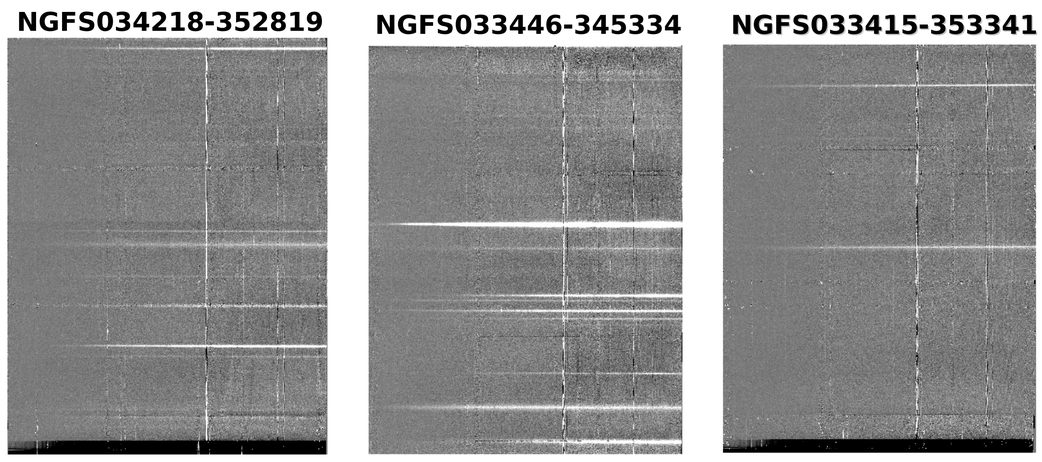


Fig. 3

TESTING DRAGONS reduction process for long slit GMOS spectra (quick look mode available for now).

Data set: **GS-2015B-FT-2**
Three dwarfs from NGFS sample,
Calibration: Bias (std,sci),Flat (GCAL), Arcs, standard.

Fig. 4: 2-D spectrum for three dwarfs as preliminary results of DRAGONS reduction. Includes: bias correction,flat field, QE-correction, wavelength-calibration, distortion correction, sky-subtraction, and stacking.



Stay tuned!! more details coming for the DECam analysis part (Fig.1 and 2) soon!

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