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The Next Generation Fornax Survey (NGFS)

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The Next Generation Fornax Survey (NGFS) targets all baryonic structures down to GC masses within the virial sphere of the Fornax galaxy cluster, utilizing the optical bands u', g', and i' in conjunction with the near-infrared (NIR) J and K_s filters.

The NGFS uses an intricate observing technique to reach deep surface brightness limits that allows us to detect ultra-low surface brightness dwarf galaxies down to $\mu_{i'} \simeq 29-30$ mag/arcsec^2 (Muñoz et al., 2015; Ordenes-Briceño et al., 2018a). Using the observing efficiency of DECam on the Blanco telescope at CTIO, complemented by NIR observations from VIRCAM on the VISTA telescope at ESO, we have secured large samples of galaxies to conduct volume-limited studies of their scaling relations. We find that galaxies form in three mass domains: 1) central core accretion in dwarf galaxies ($\log \mathcal{M}_\star \lesssim 8$), 2) homologous growth in intermediate-mass galaxies ($8 \lesssim \log \mathcal{M}_\star \lesssim 10.5$), and predominant halo mass assembly in massive galaxies ($\log \mathcal{M}_\star \gtrsim 10.5$; for details see Eigenthaler et al., 2018). Furthermore, we find a bimodal scaling relation between the masses of the nuclear star cluster and their host galaxy spheroid (Ordenes-Briceño et al., 2018b). While dwarf galaxies with masses $\log \mathcal{M}_\star \lesssim 8$ show an anticorrelation between $\eta = \mathcal{M}_{\rm nuc}/\mathcal{M}_{\rm gal}$ and the galaxy mass, the higher mass galaxies show a positive correlation. We speculate that a mixture of in-situ formation and accretion mechanisms is at play without clear support from current theoretical predictions.

New results based on the Hα-imaging extension of NGFS show intriguing, localized recent star-formation activity in galaxies. In particular, dwarf galaxies show both Hα absorption and emission signatures in their central regions. The depth and spatial resolution of the Hα imaging data allows us to resolve the star-formation (SF) properties of NGFS galaxies. We find that while the integrated Hα properties of galaxies align well with the standard SF scaling relations of galaxies (e.g. Peng et al., 2010), there is significant variance of the SF-ing regions in individual galaxies (up to 6 orders of magnitude).

Our most recent analyses related to the dynamical properties of satellite galaxies in the Fornax galaxy cluster identified a distinct transition radius, demarcating two zones where satellites exhibit varying properties of tidal

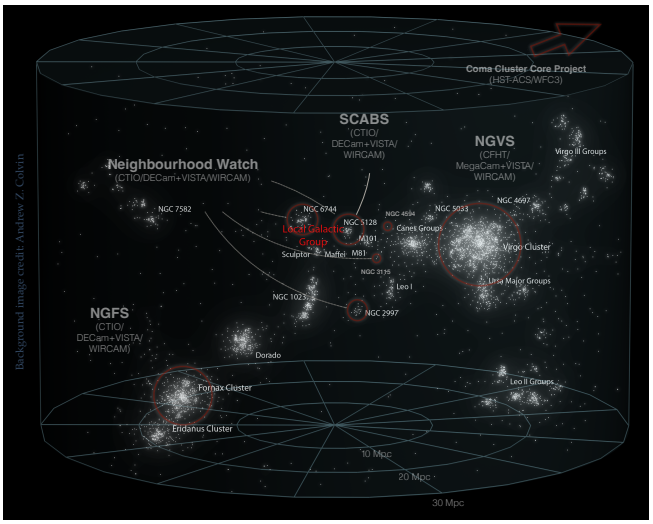

Figure 1. Surveys targeting the most important baryonic overdensities in the Local Universe (within 30 Mpc) studied by our research team. Note that the Coma galaxy cluster lies at a distance of about 100 Mpc (background image credit: Andrew Z. Colvin, licensed under the CCA-Share Alike 3.0 Unported license).

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stress. Intriguingly, this substructure mirrors patterns observed in cosmological galaxy simulations. Furthermore, when examining diverse cosmic environments, we discern a comparable transition radius in the Virgo galaxy cluster, as well as among the satellite galaxies of both the Milky Way and Andromeda (Blaña et al., in prep.).

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