Ultra-deep imaging: from cosmology to ISM studies

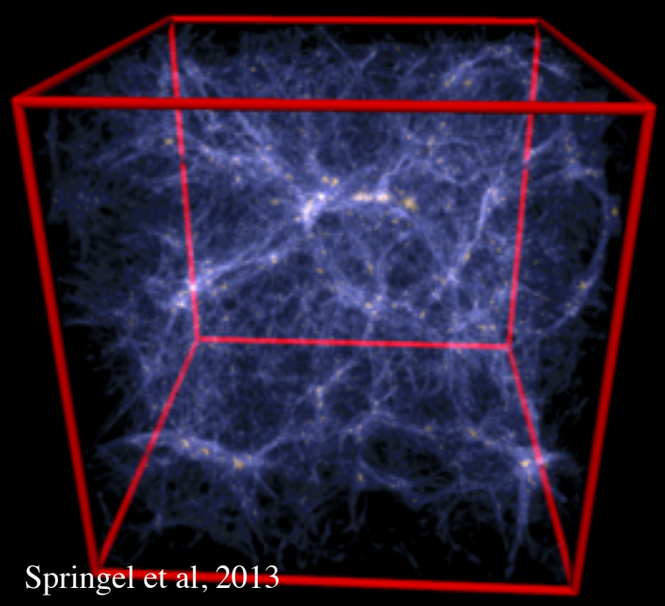
galaxy archeology with the diffuse light

Pierre-Alain Duc

PNCG 2015 - Nice

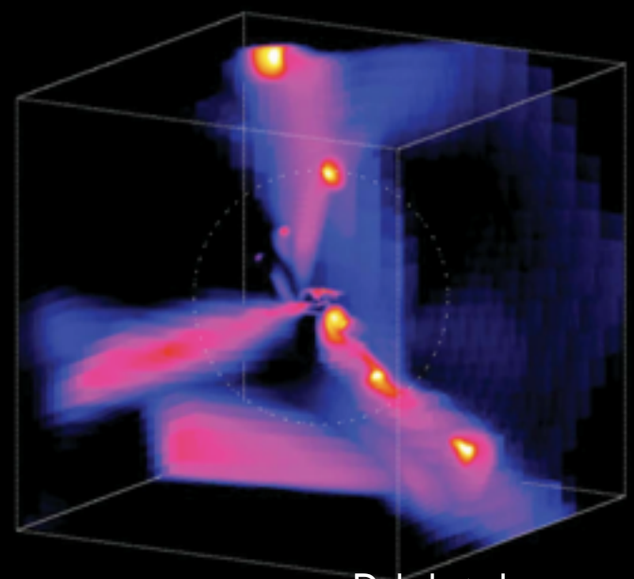
MAZLAS

Cosmology: how galaxies have assembled their mass and shaped their morphology?

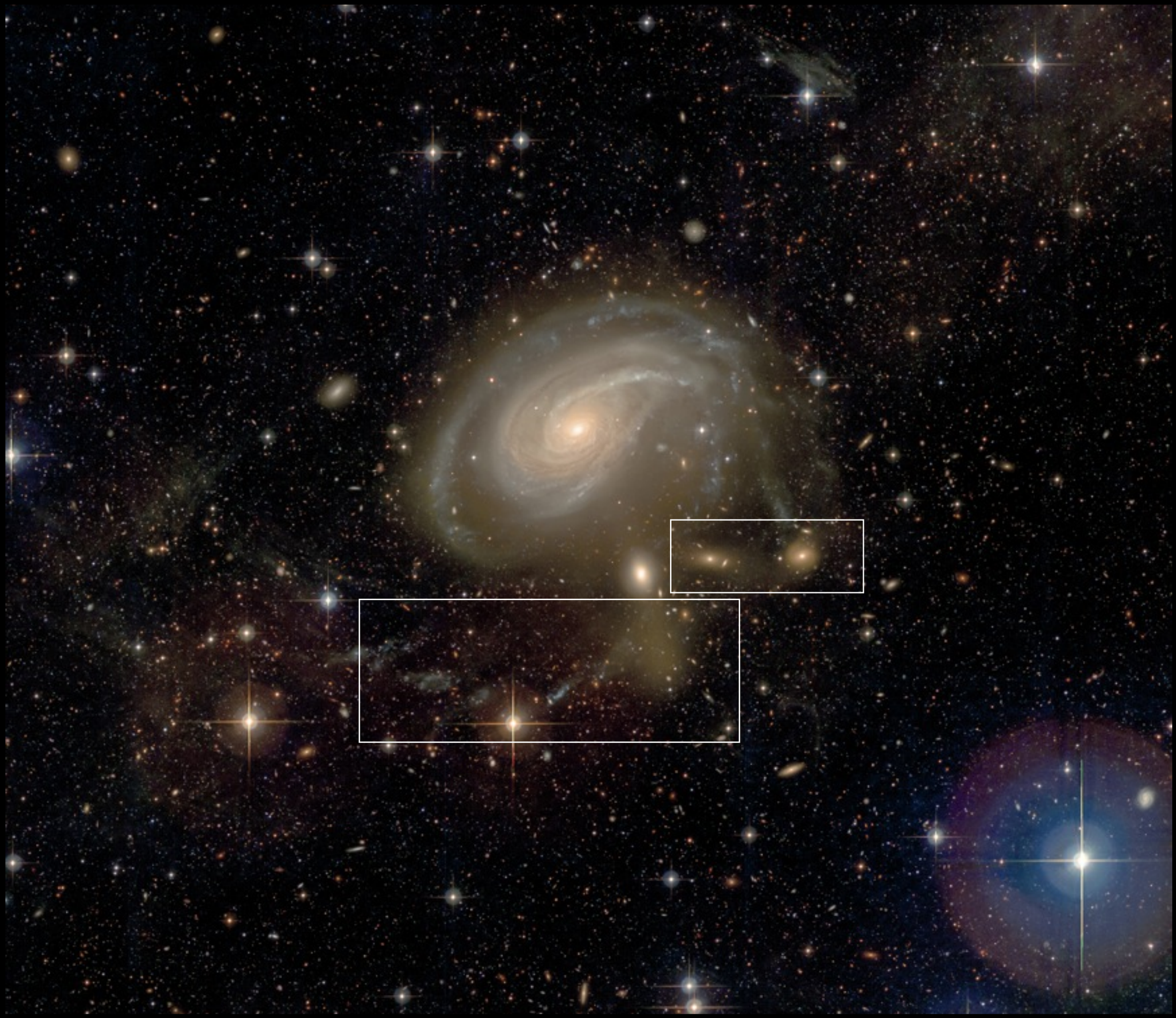


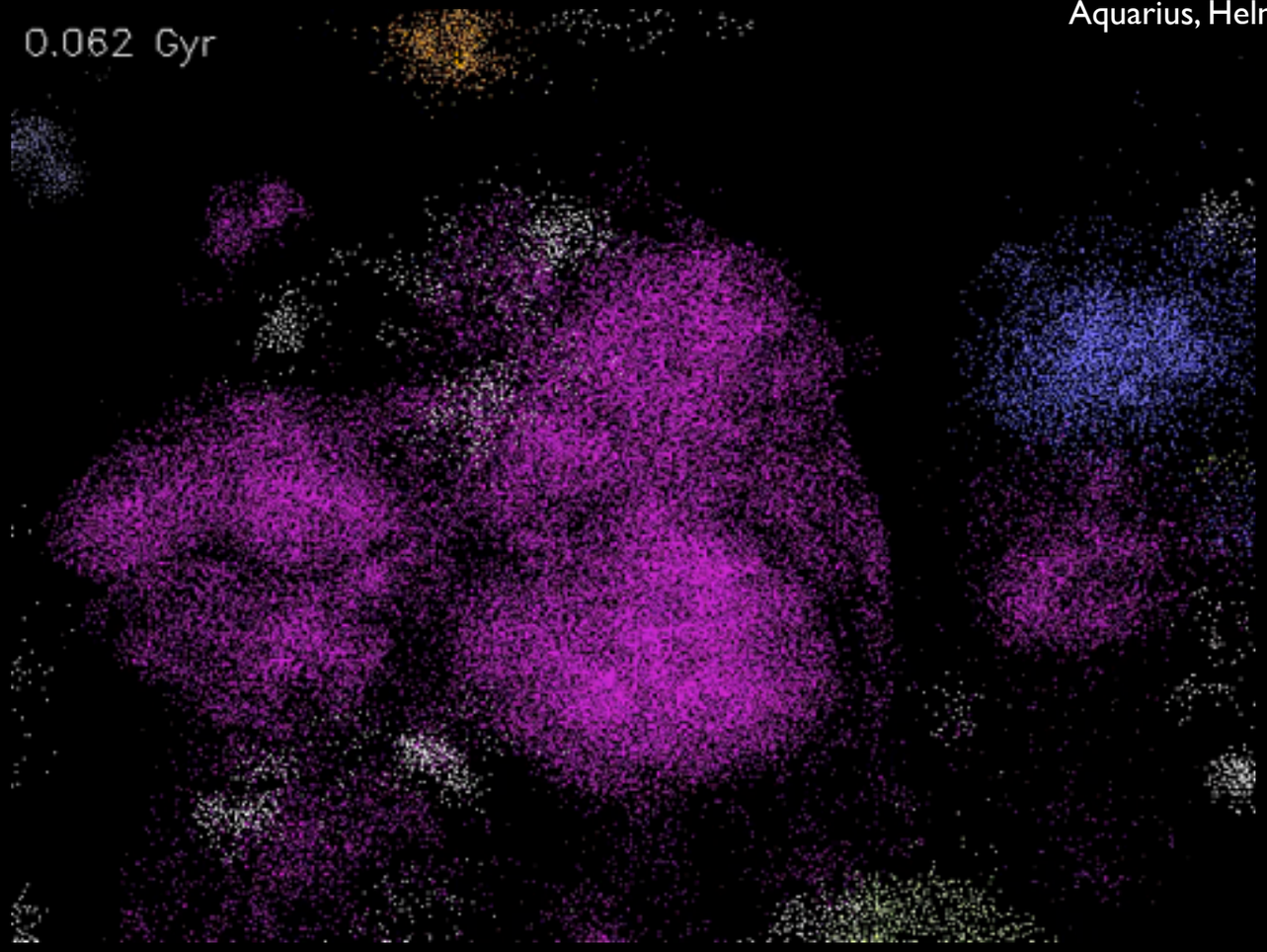
Springel et al, 2013

The role of mergers vs cold accretion and secular evolution



Dekel et al.

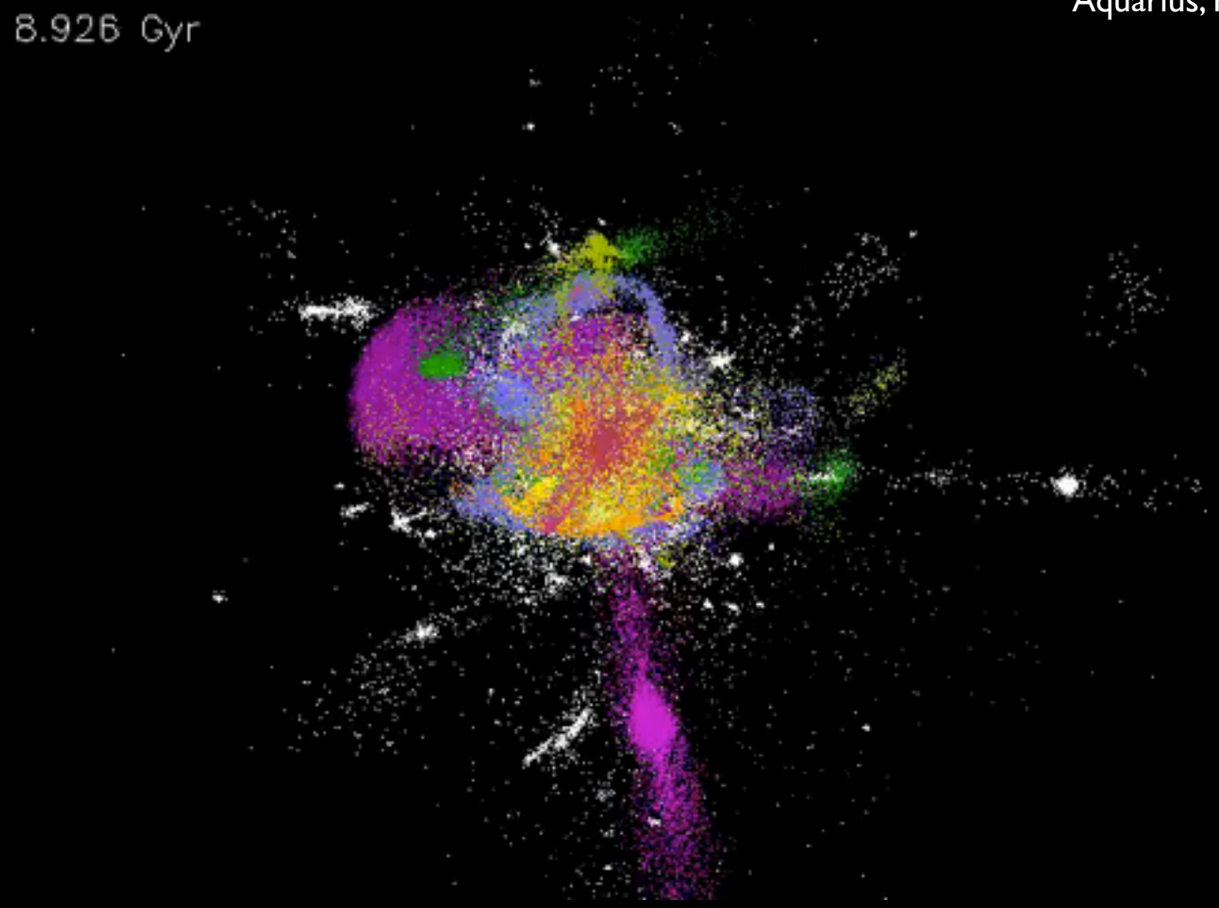




Aquarius, Helmi et al.

How galaxies have assembled their mass and shaped their morphology?

The role of mergers vs cold accretion and secular evolution probed by collisional debris



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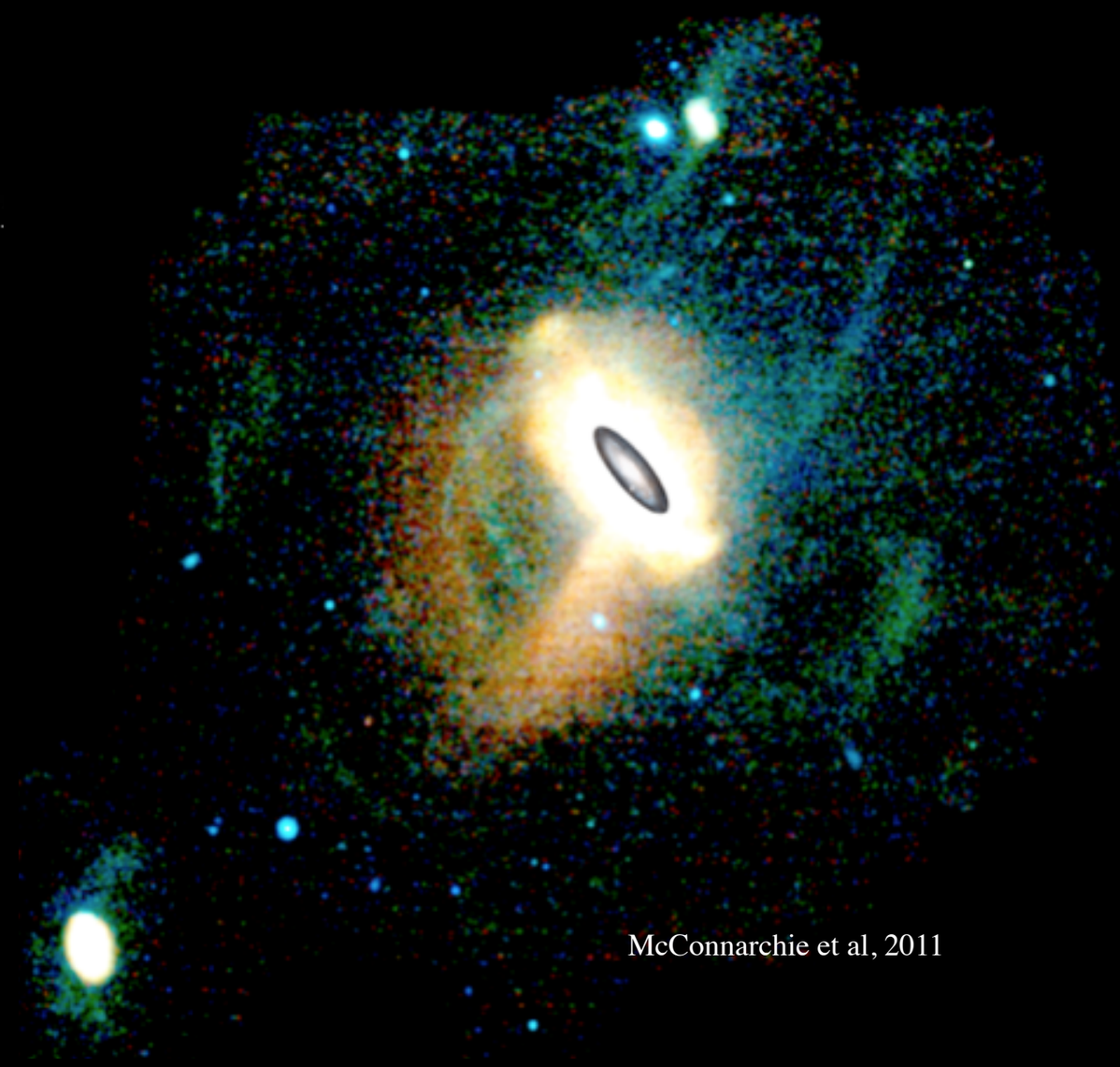
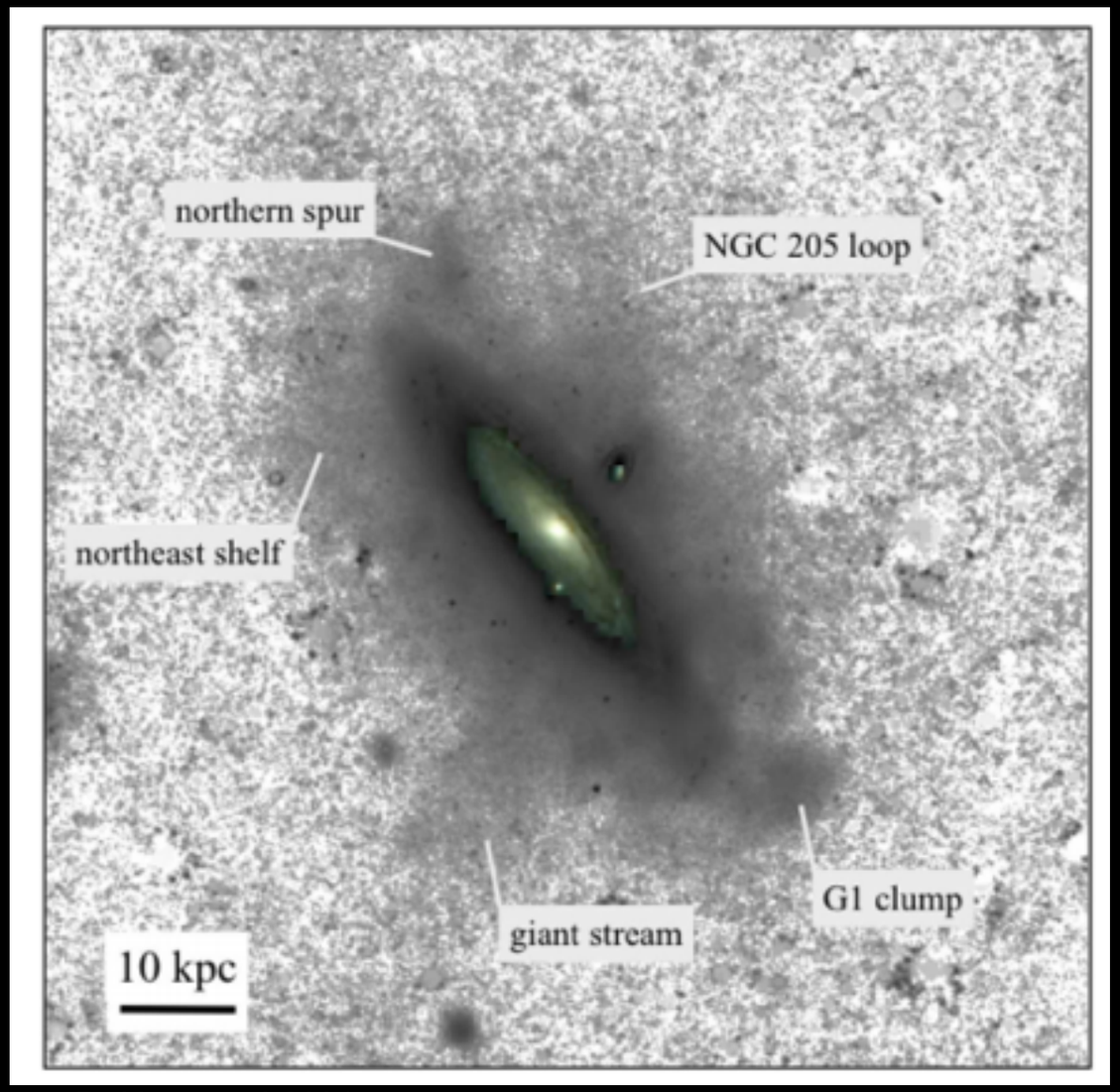
How galaxies have assembled their mass and shaped their morphology?



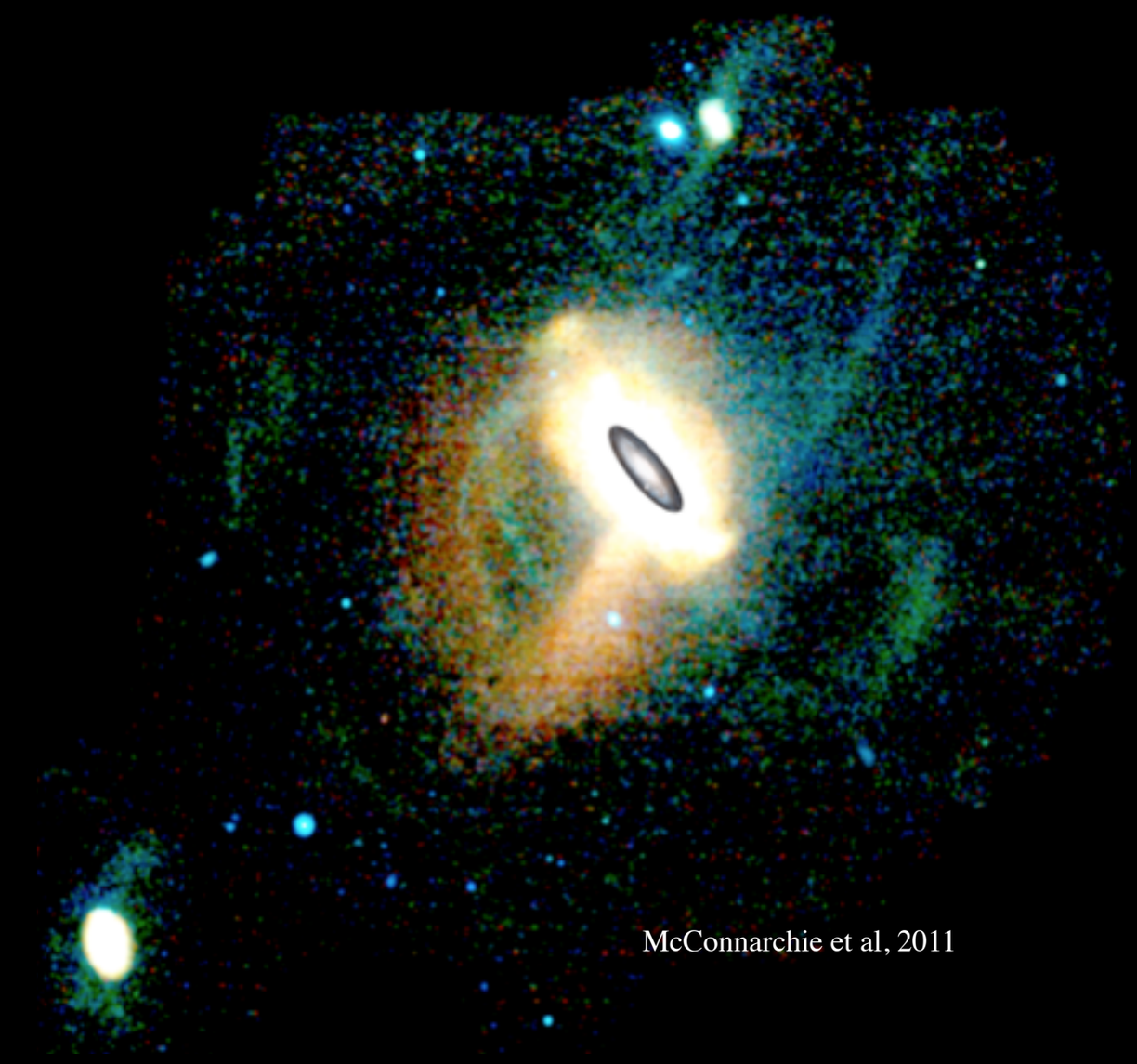
McConnarchie et al, 2011

Collisional debris probed with “galactic archeology” with stellar counts

How galaxies have assembled their mass and shaped their morphology?

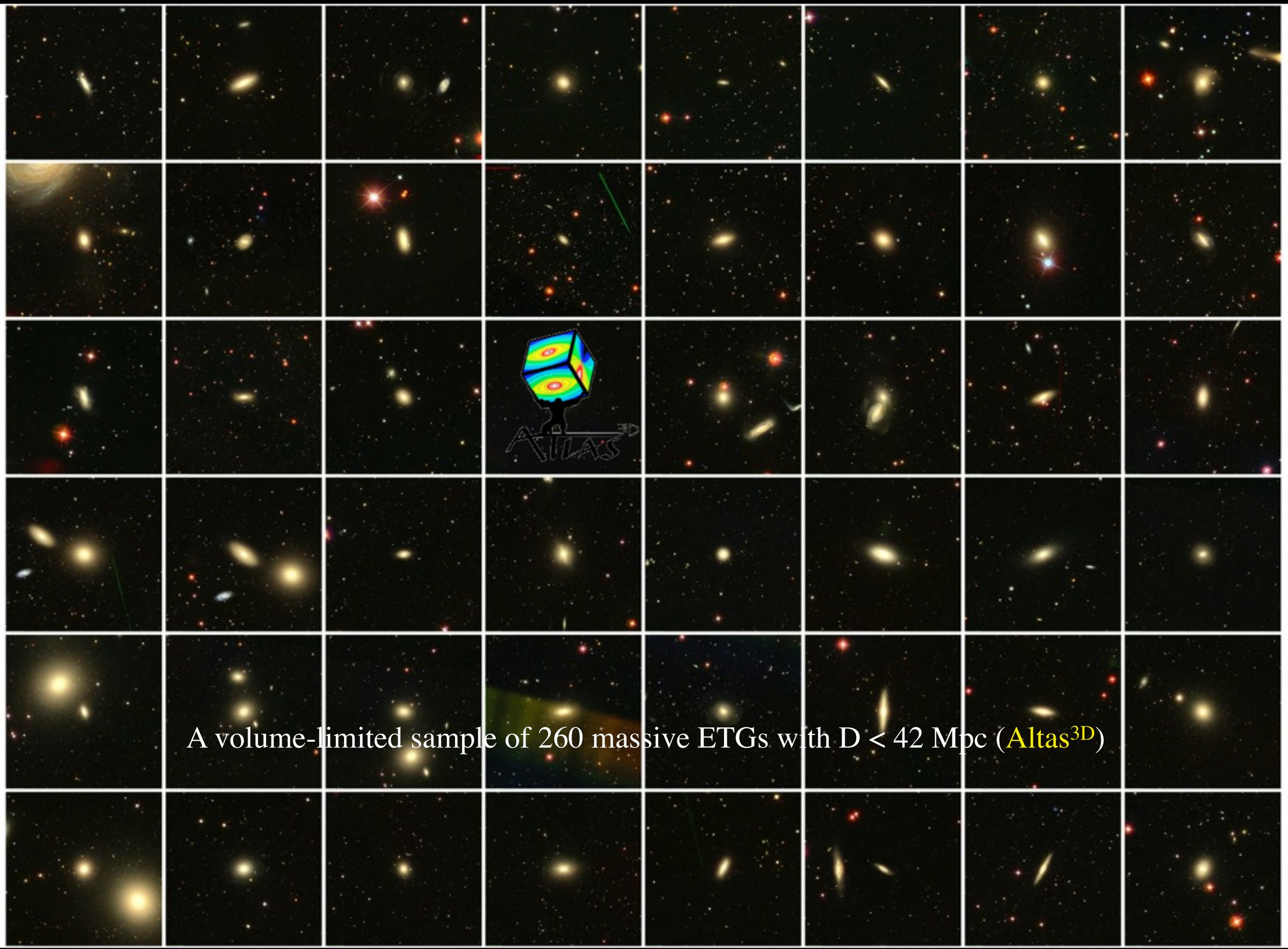


van Dokkum et al. 2014



McConnarchie et al, 2011

Outside the Local Group: galaxy archeology done with the diffuse light: access to a variety of morphology and statistical studies

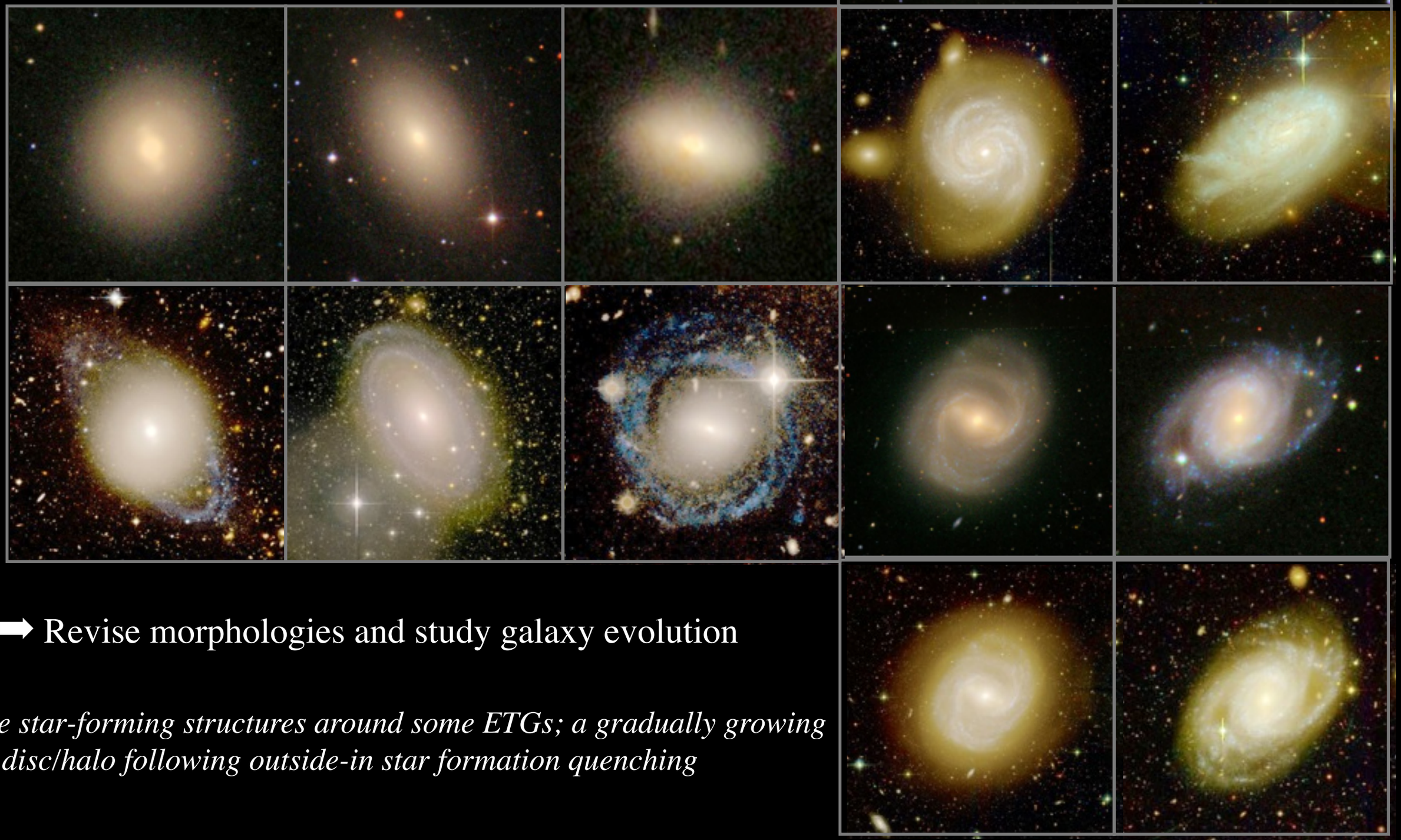

A volume-limited sample of 260 massive ETGs with D < 42 Mpc (Altas3D)

A volume-limited sample of 260 massive ETGs with D < 42 Mpc (Altas^{3D})
(and 100 LTGs) observed with MegaCam at the CFHT.
A dedicated observing strategy and pipeline to reach 29 mag/arcsec2

SDSS images of the Atlas^{3D} ETGs

Atlas^{3D} ETGs as seen by MegaCam

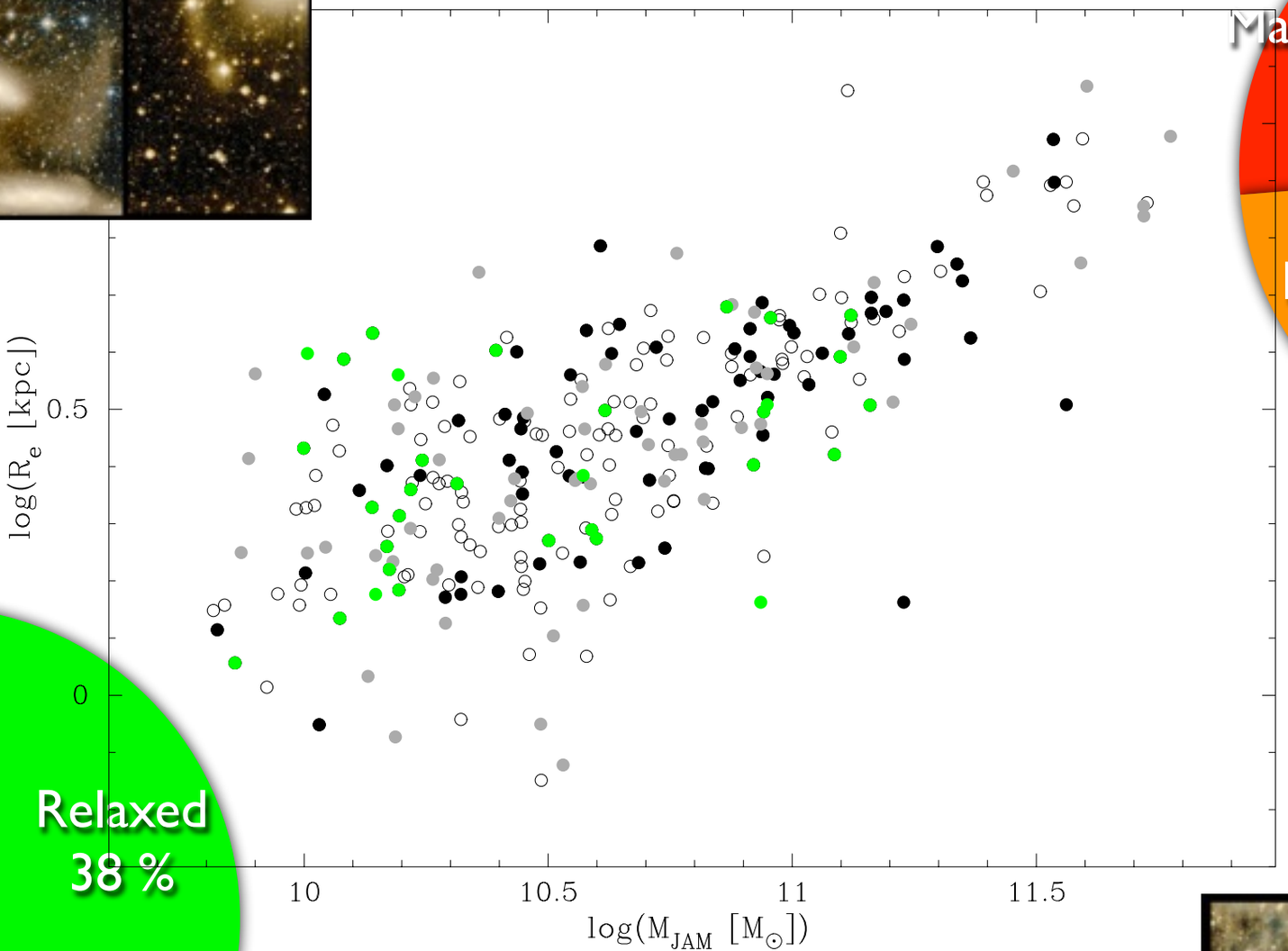
Results of the MATLAS and NGVS surveys

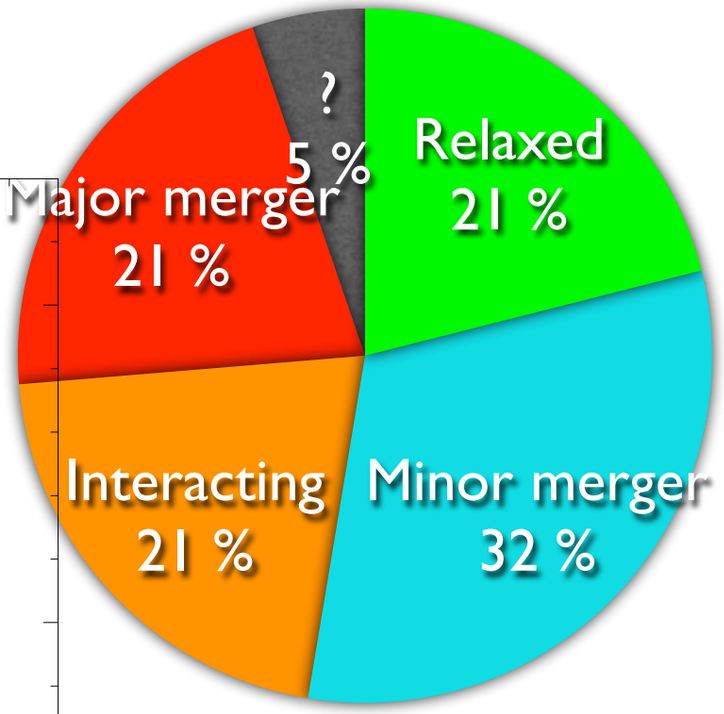


➡ Revise morphologies and study galaxy evolution

Blue star-forming structures around some ETGs; a gradually growing red disc/halo following outside-in star formation quenching

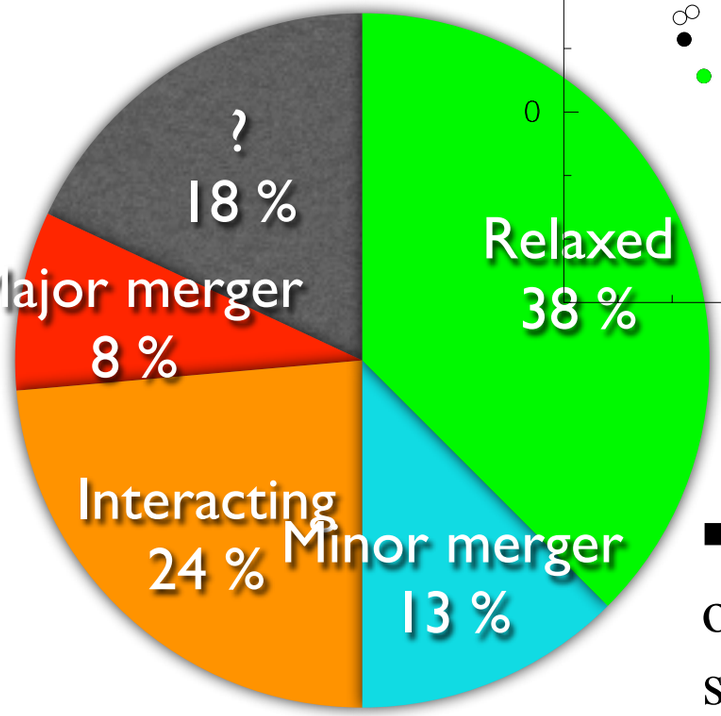
Results of the MATLAS and NGVS surveys





log(M)>11*

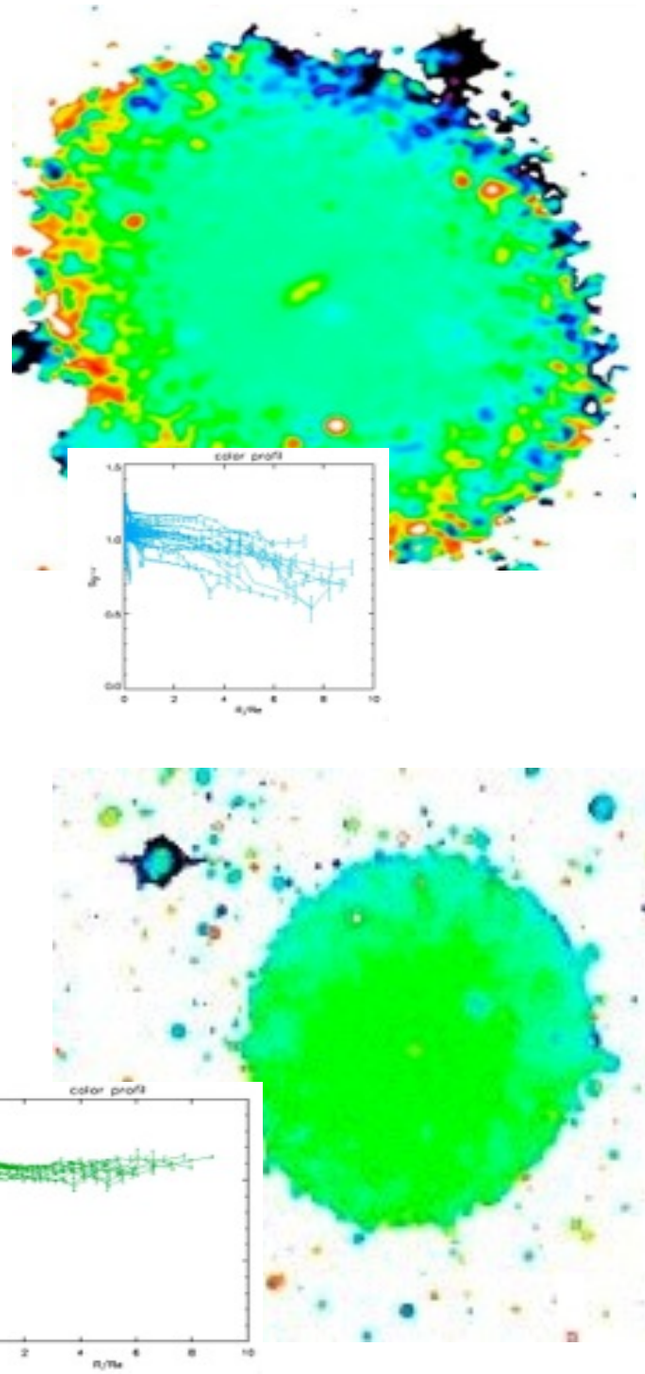
Duc et al., 2015

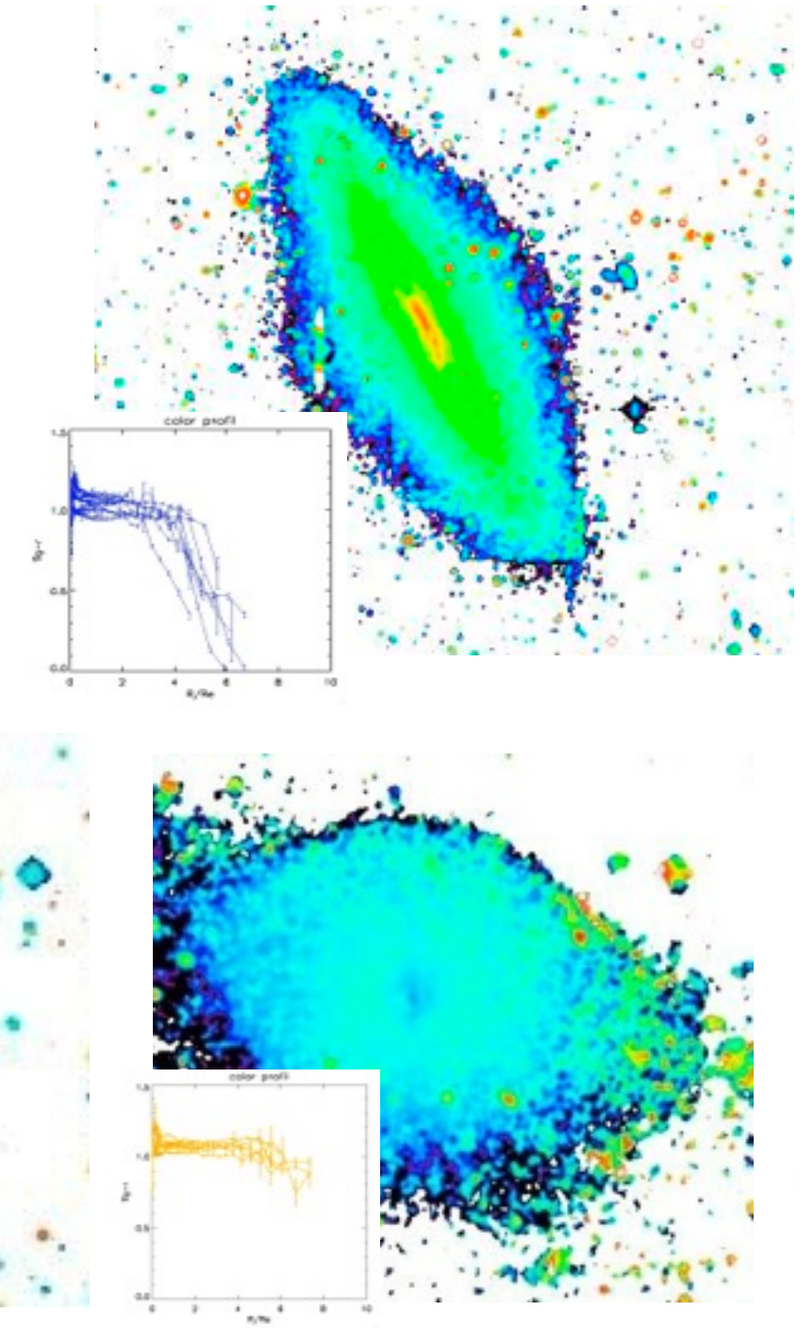


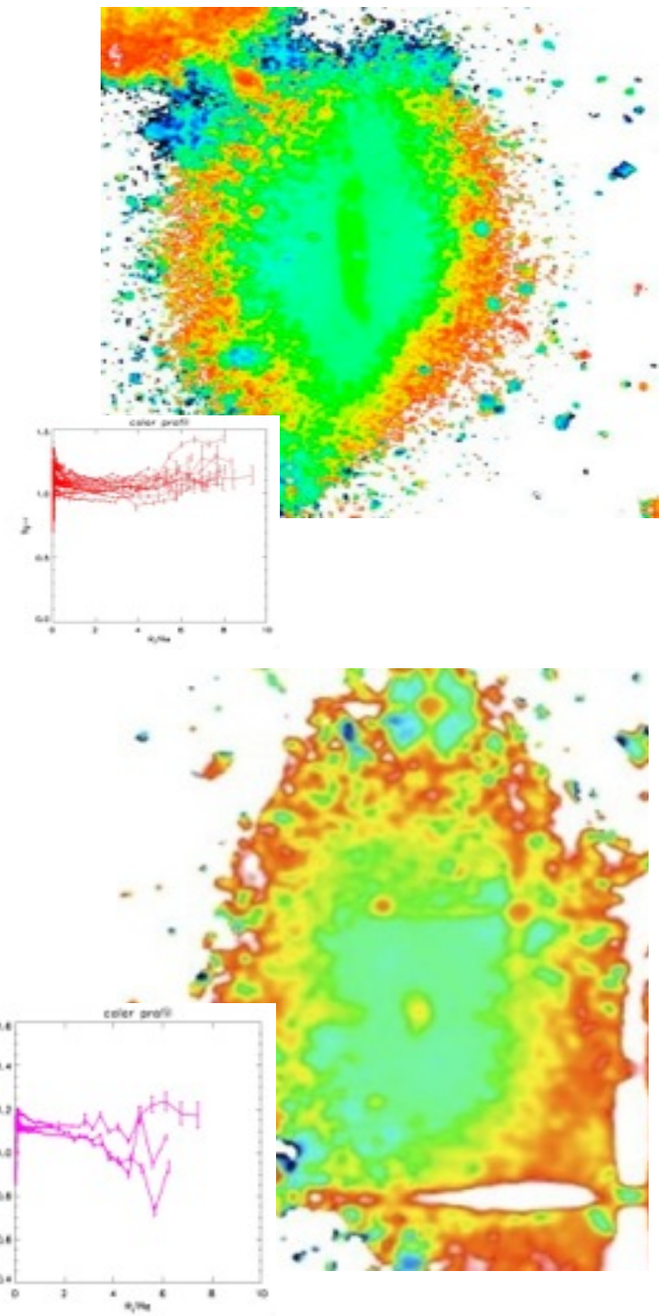
log(M)<11*

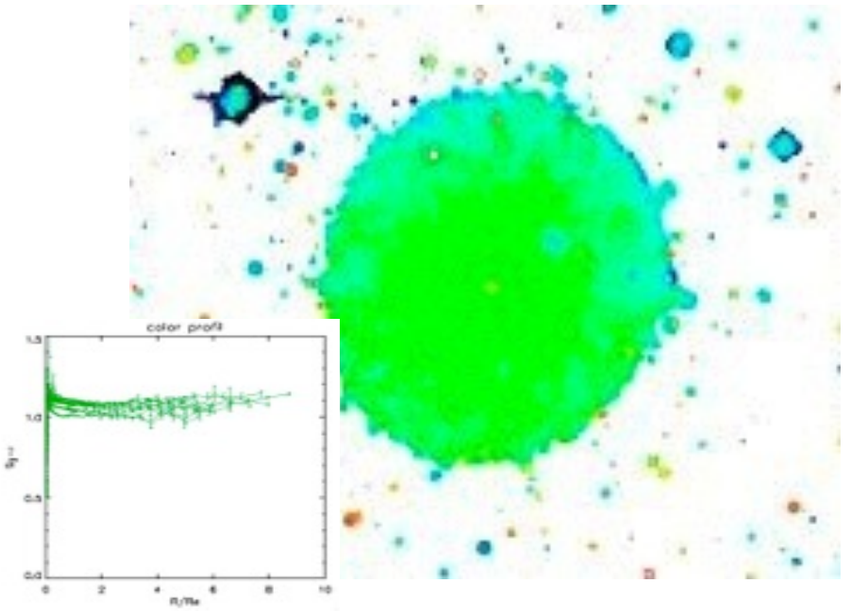
➡Do statistics on the frequency and shape of tidal structures, and correlate a fine structure index with global/internal properties of galaxies, and predictions from simulations

Results of the MATLAS and NGVS surveys



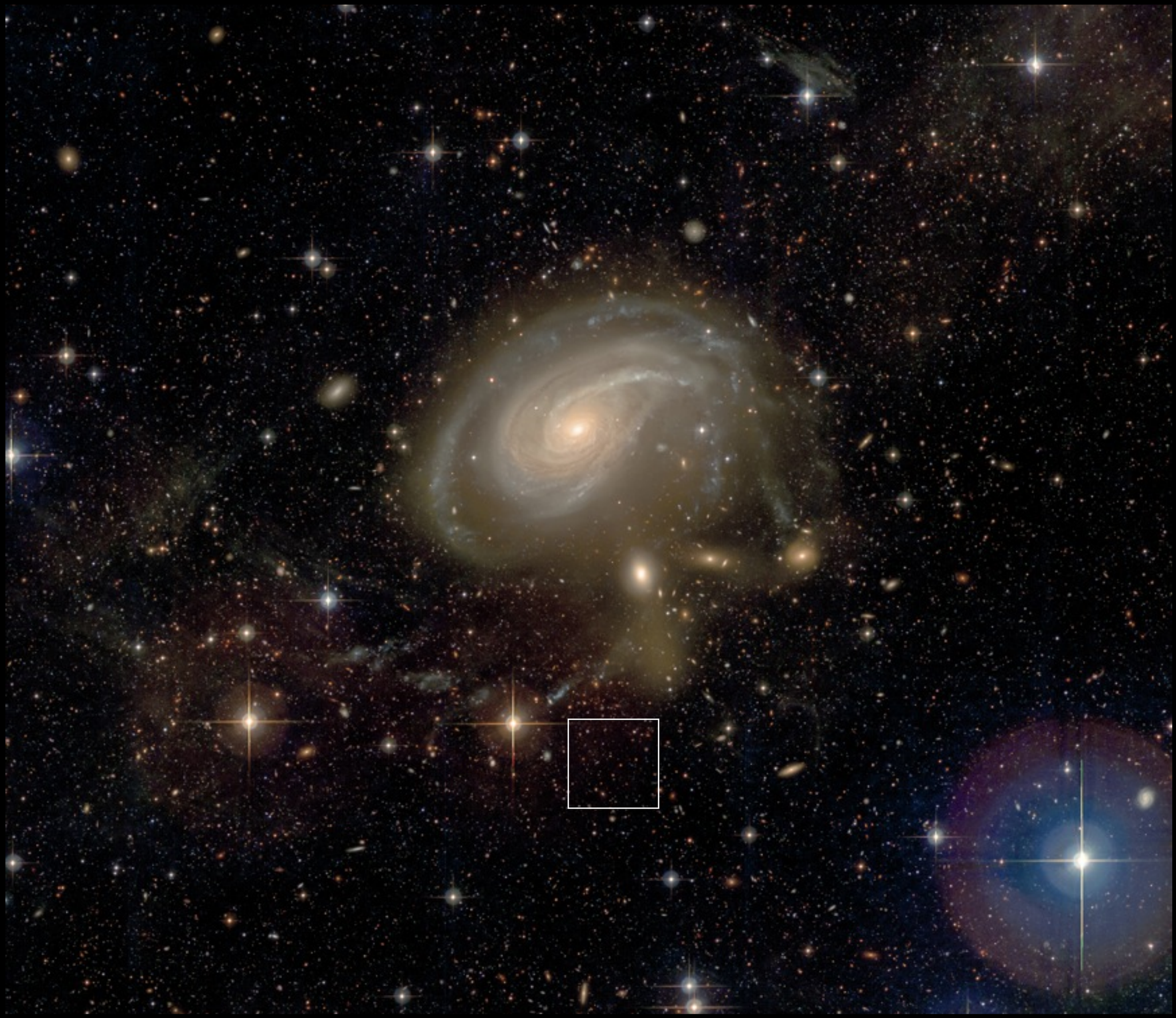




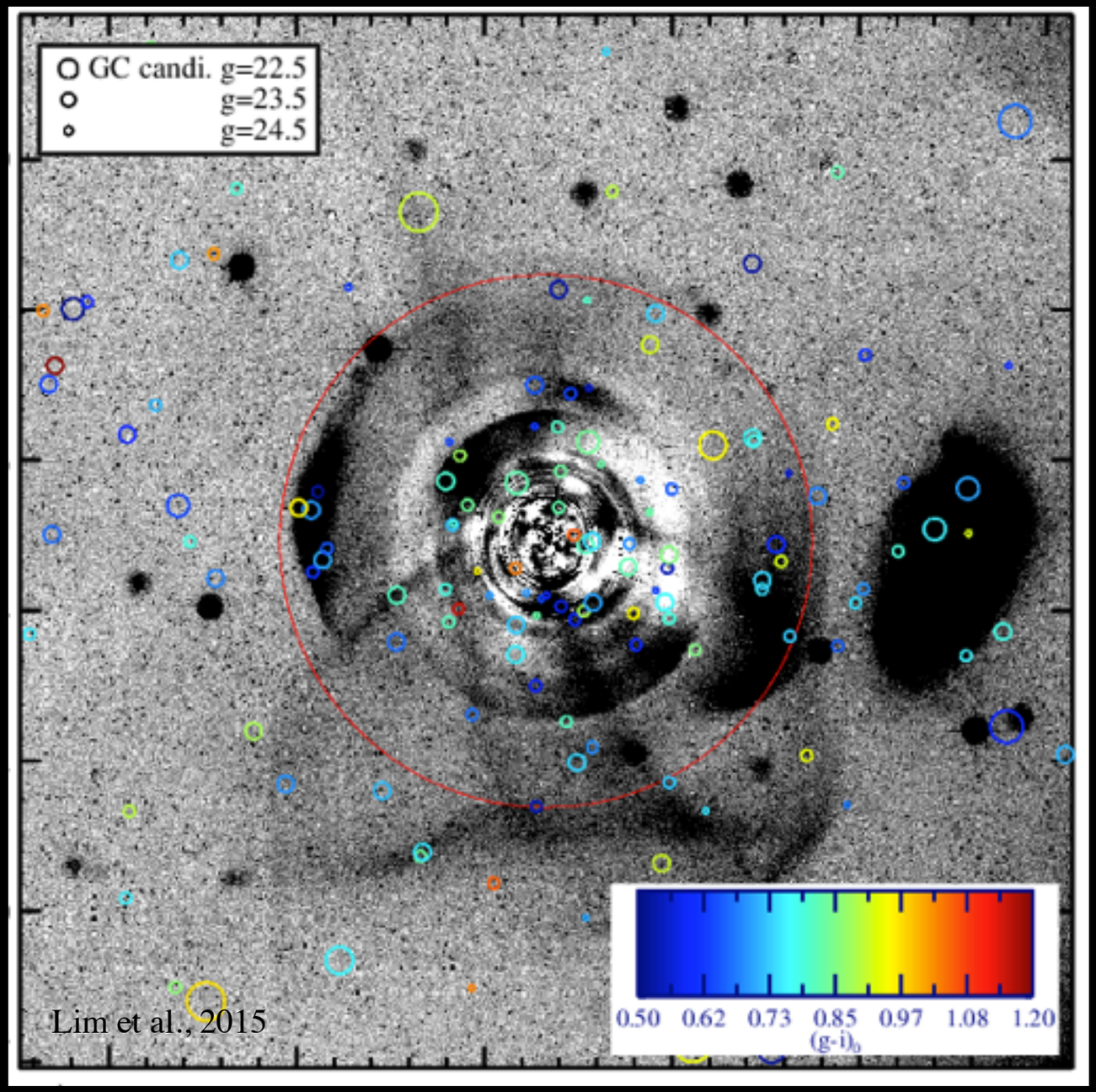


➡Do statistics on the color profiles at large radius, correlate them with global/internal properties of galaxies, and predictions from simulations

Karabal et al., 2015

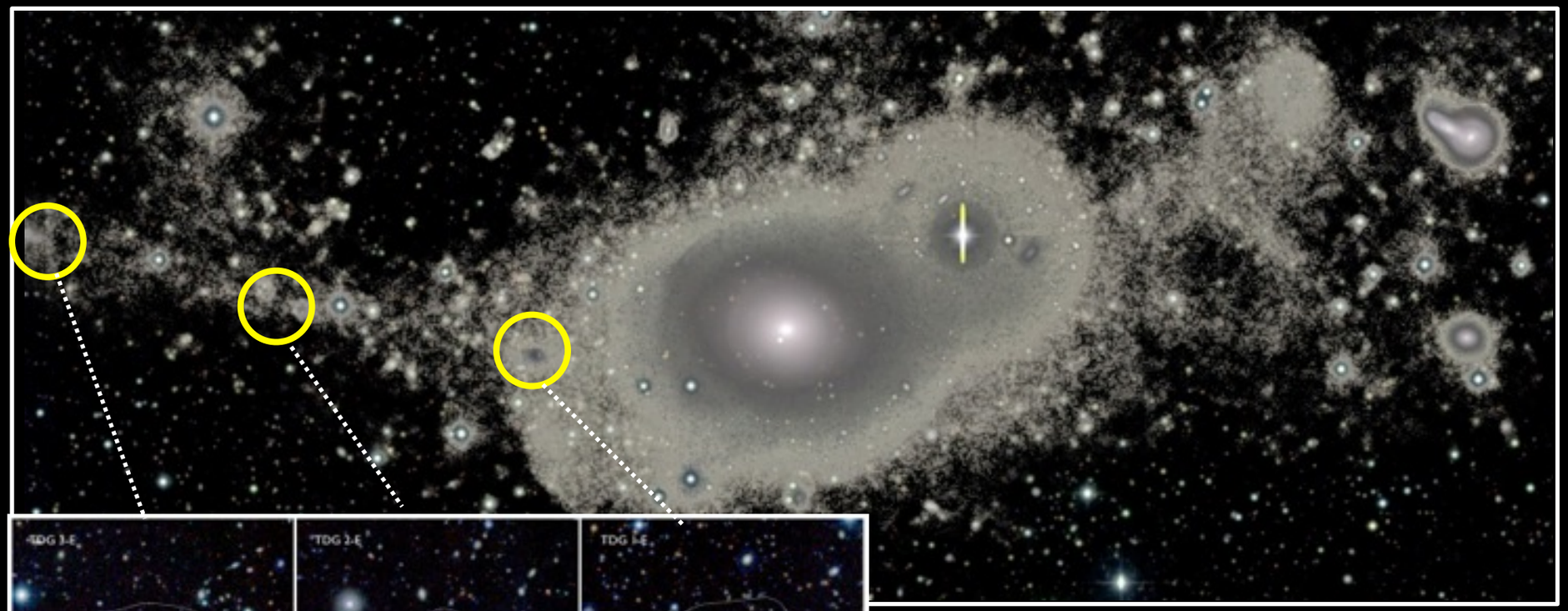


On-going studies with the MATLAS and NGVS surveys



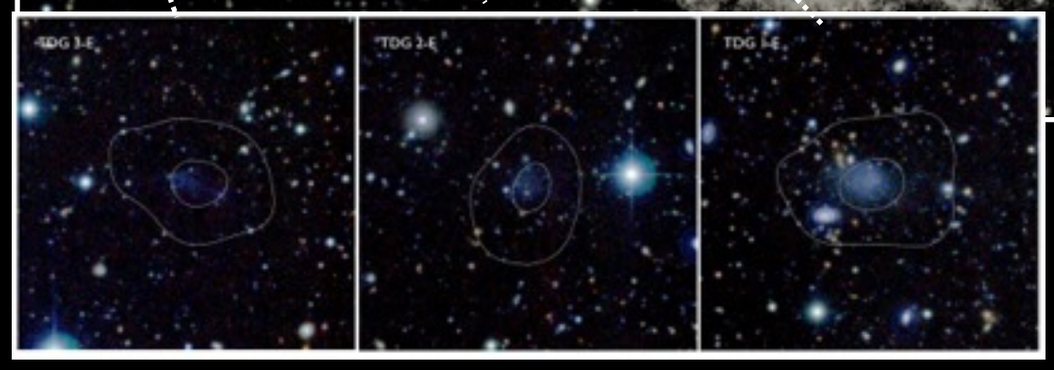
➡ Probe the outer most regions with globular clusters and use them as tracers of kinematics

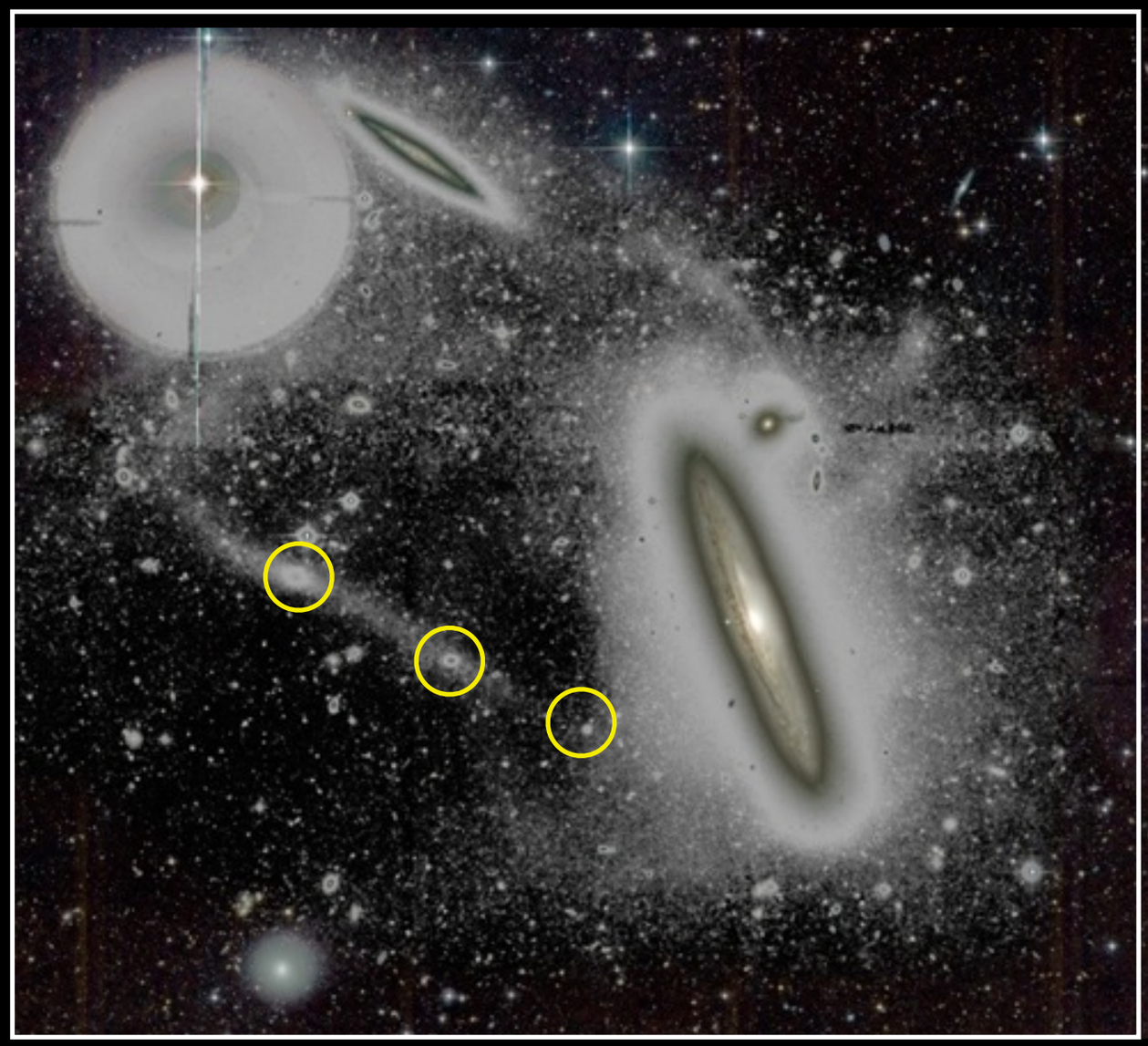
➡Active field of research with strong competitive teams



On-going studies with the MATLAS and NGVS surveys

Duc et al., 2013





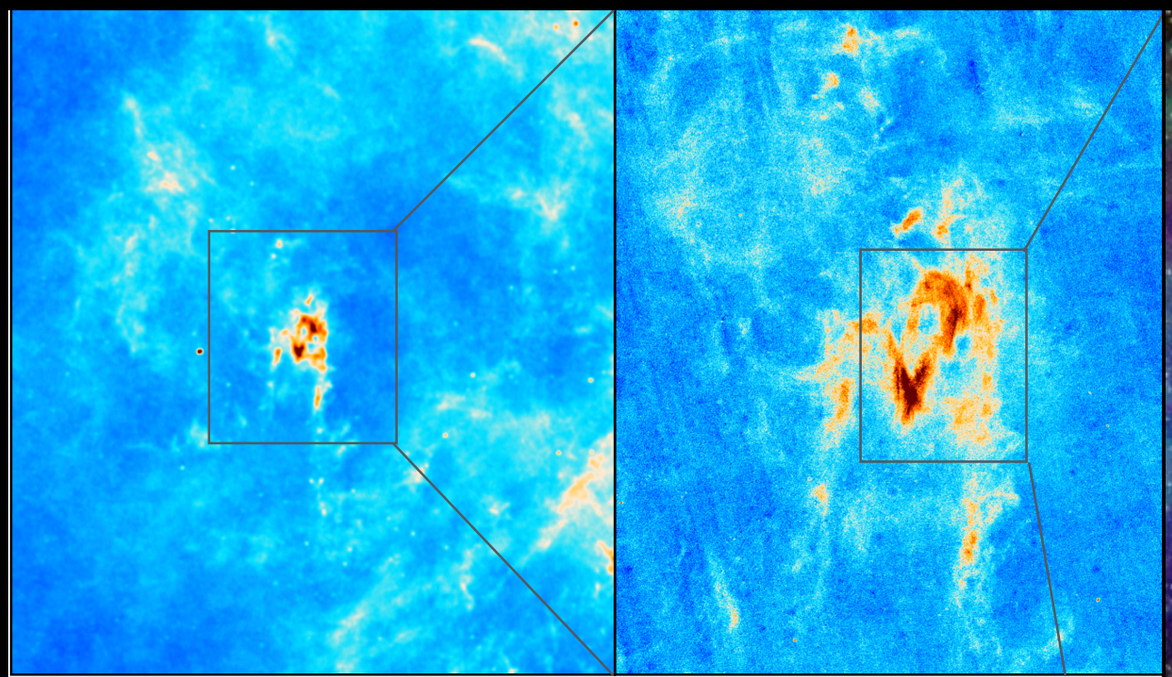
➡ A systematic survey of LSB dwarfs / ultra-faint dwarfs in various environments

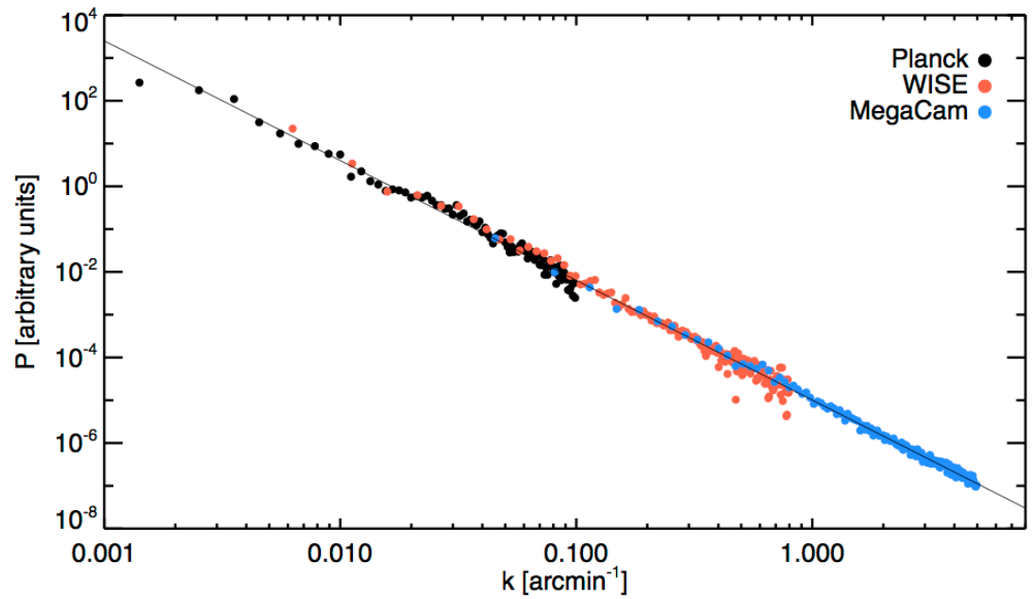
➡ Probe the origin of disk of satellites: tidal dwarf galaxies vs cosmological accretion

Paudel et al., 2013, Smith et al., 2015

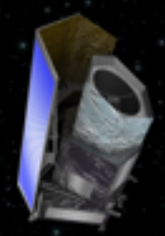
➡ Study the ISM at very high spatial resolution with the scattered of nearby Galactic cirrus

Miville-Deschenes et al., 2015

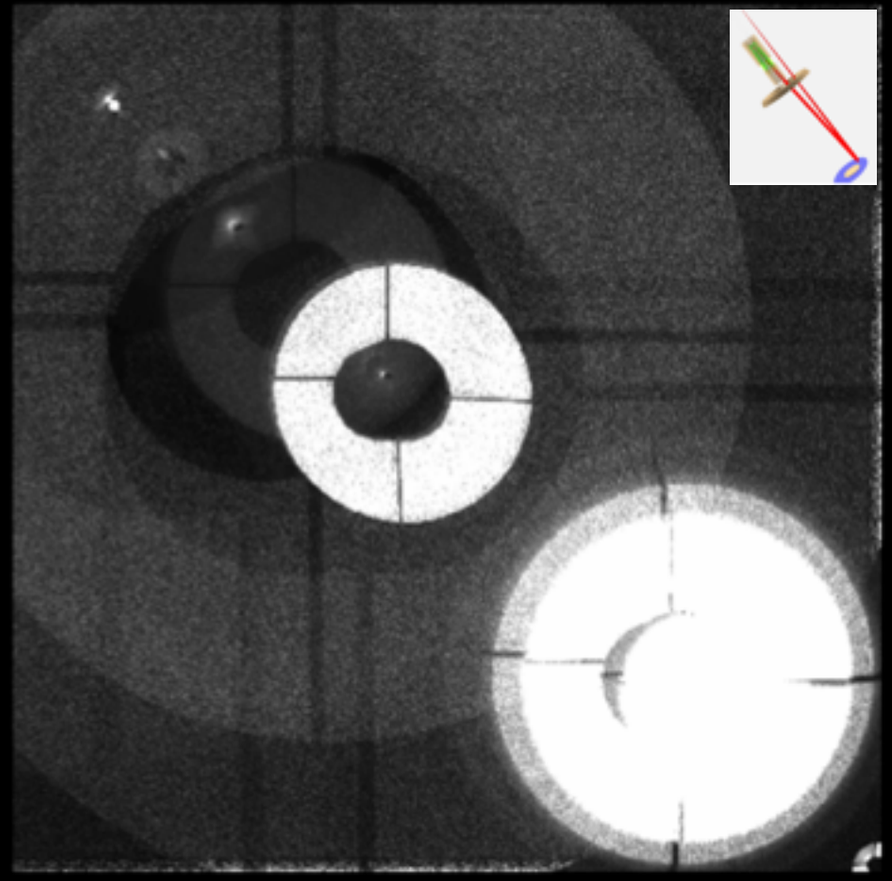




➡A challenge and opportunity for Euclid: cirrus emission everywhere



➡ Model of the camera internal reflections with ray tracing. Alternative methods developed



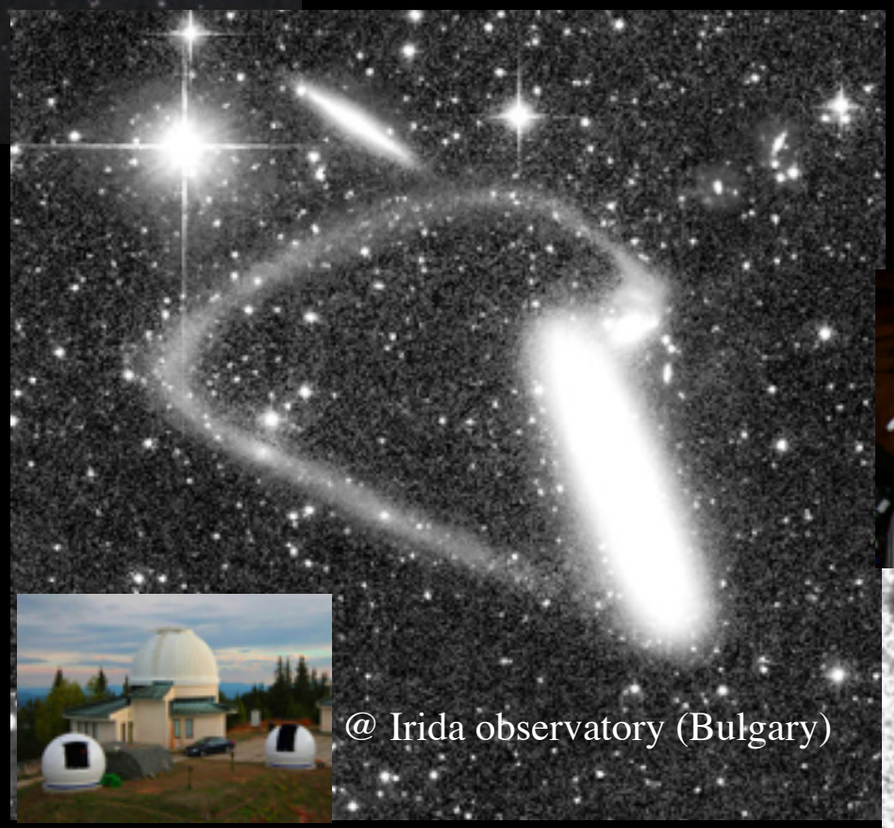
Regnault et al., in prep

➡ A technical challenge: modeling and removing the ghost halos: presently the main limitation of ultra-deep imaging

@ blackbird (USA)

➡ Future of deep imaging

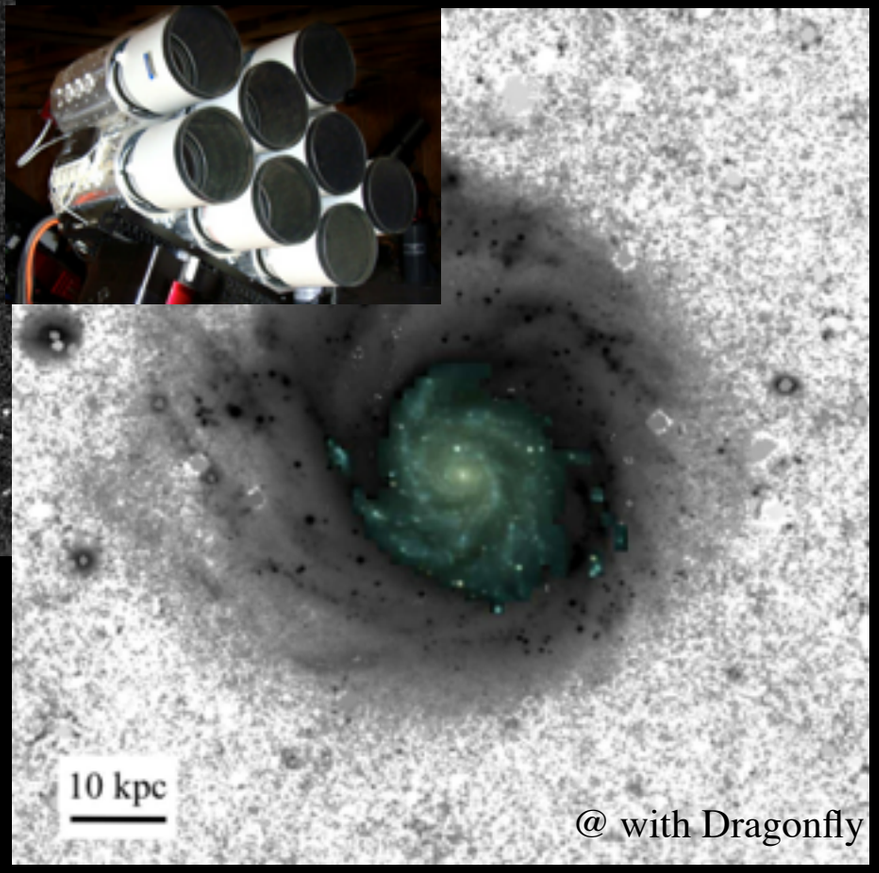
- Use current or planned facilities, with post-processing to correct for systematic effects (e.g. PSF modeling) => CFIS @ CFHT, LSST, Euclid
- Use amateur telescopes with “simple” camera => network of telescopes
- Develop new instrumental concepts, minimizing scattered light => Dragonfly, Messier



@ Irida observatory (Bulgary)

➡ Multiple on-going efforts, surveys (dedicated: MATLAS, or using existing data: Stripe 82)

➡ Complementing LG studied and Gaia



@ with Dragonfly

Merci with love!