



VESTIGE

A Virgo Environmental Survey Tracing Ionised Gas Emission

A CFHT Large Program 2017-2019

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<http://mission.lam.fr/vestige/index.html>



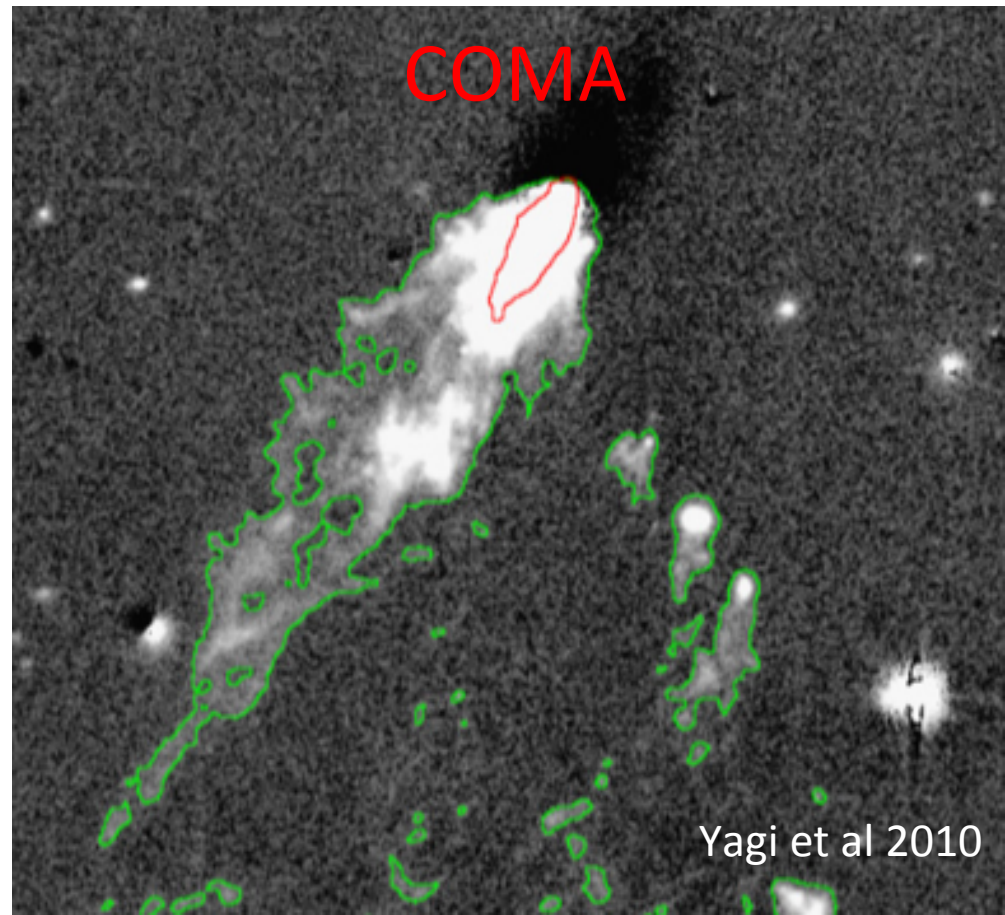
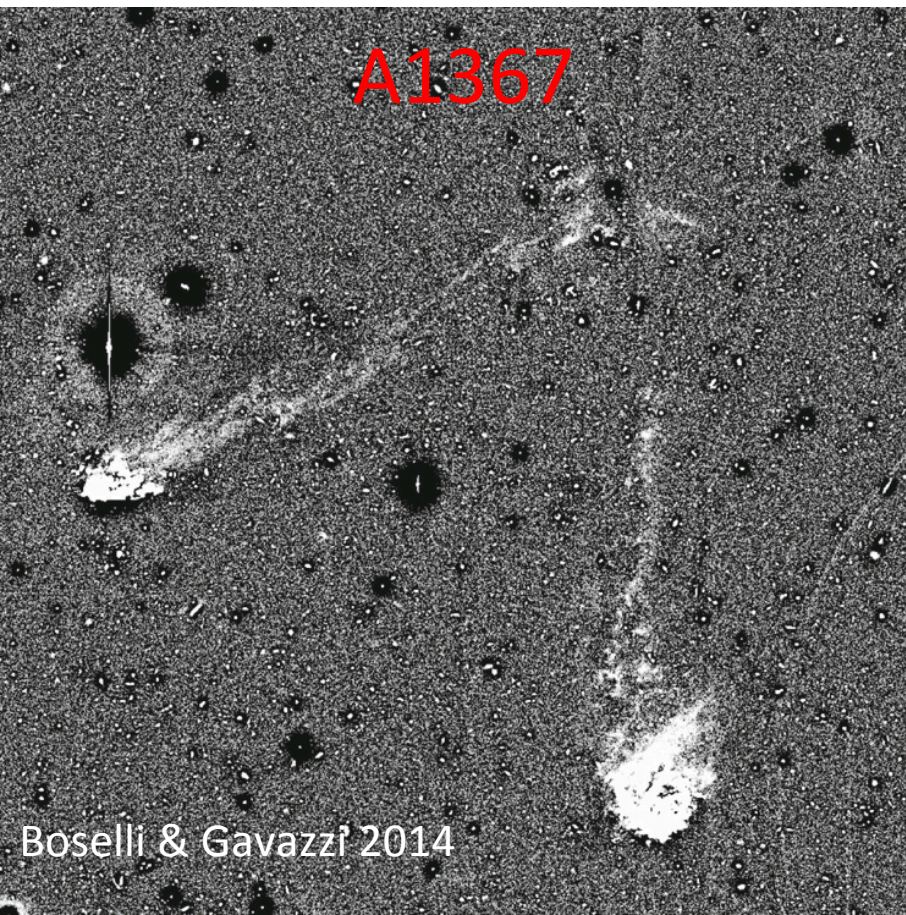
INTRODUCTION: THE ROLE OF THE ENVIRONMENT ON GALAXY EVOLUTION

Different mechanisms in high-density regions contribute to shape galaxy evolution:

- 1) **Gravitational** (tidal interactions, harassment..)
 - 2) **Interactions with the ICM** (ram pressure, thermal evaporation, viscous stripping, starvation...)
 - 3) **Pre-processing**
- Which of these is the dominant mechanism?
 - Is the physics of these mechanisms fully understood and correctly accounted for in models and simulations?

INTRODUCTION: THE METHOD

Deep blind H α narrow-band imaging surveys are at present the best method to detect an undergoing perturbation.





INTRODUCTION: THE VESTIGE SURVEY

VESTIGE IS A BLIND H α NARROW-BAND IMAGING SURVEY OF THE VIRGO CLUSTER DESIGNED TO:

- Quantify the fraction of cluster late-type galaxies undergoing a perturbation
- Identify the dominant perturbing mechanism
- Understand how the star formation process is affected by the perturbation?



INTRODUCTION: THE VIRGO CLUSTER

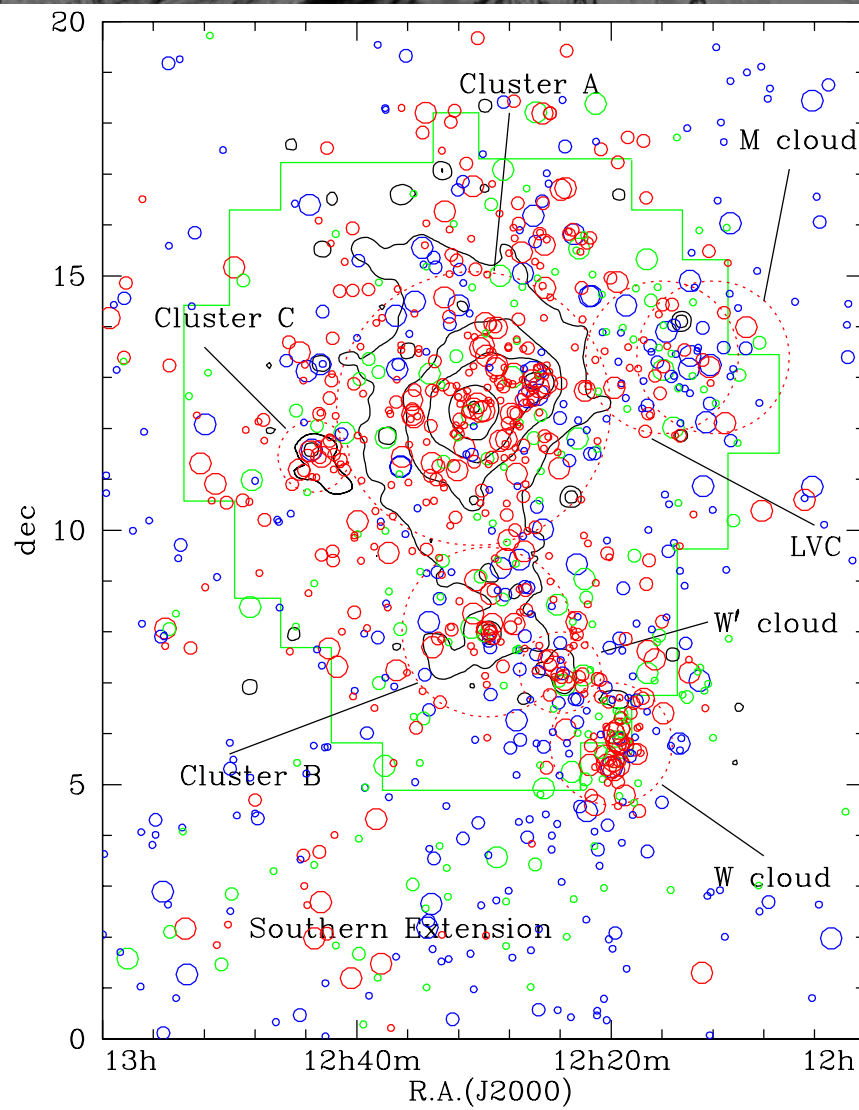
- The richest and closest cluster of galaxies (16.5 Mpc)
- excellent angular resolution (1 arcsec = 80 pc)
- access to the dwarf population ($M_{\text{star}} \sim 10^5 \text{ Mo}$)
- Spiral rich cluster in formation
- Multifrequency data available: **GUViCS** (UV, Boselli et al 2011); **NGVS** (visible, Ferrarese et al 2012); **HeViCS** (FIR, Davies et al 2010); **ALFALFA+VIVA+ASKAP** (HI, Giovanelli et al 2005, Chung et al 2009)



OBSERVING STRATEGY

- 50 allocated night with MegaCam ($1^\circ \times 1^\circ$) to cover the Virgo cluster within 1 virial radius ($\sim 104^\circ$)
- Integration time: 2 h in the $H\alpha$ filter ($\lambda = 6563 \text{ \AA}$, $\Delta\lambda = 106 \text{ \AA}$; $T = 93\%$), 12 min in r (for the stellar continuum subtraction)
- Sensitivity: $f(H\alpha) \sim 4 \times 10^{-17} \text{ erg sec}^{-1} \text{ cm}^{-2}$ (5σ) for point sources; $\Sigma(H\alpha) \sim 2 \times 10^{-18} \text{ erg sec}^{-1} \text{ cm}^{-2} \text{ arcsec}^{-2}$ (1σ) for ext. sources at $3''$ res

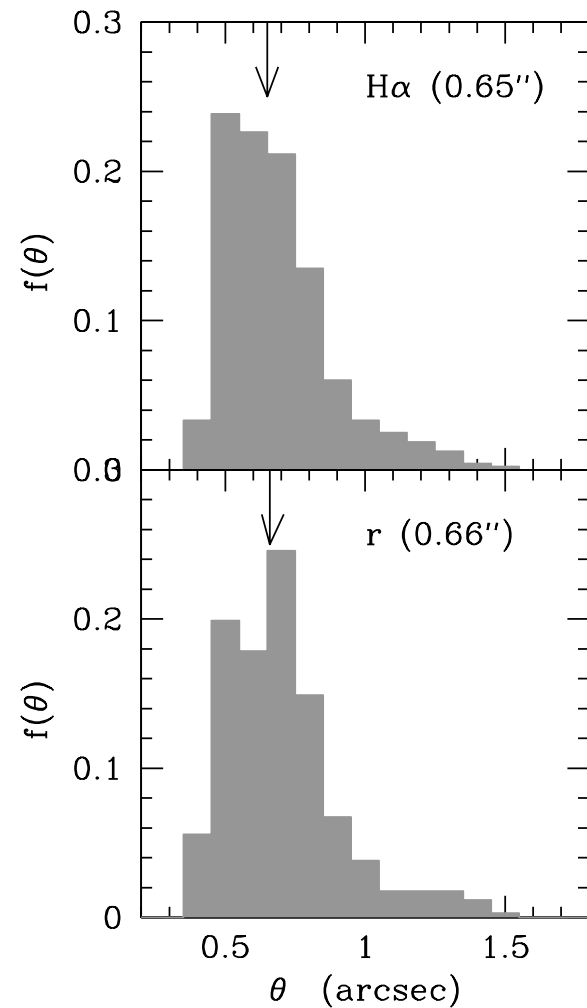
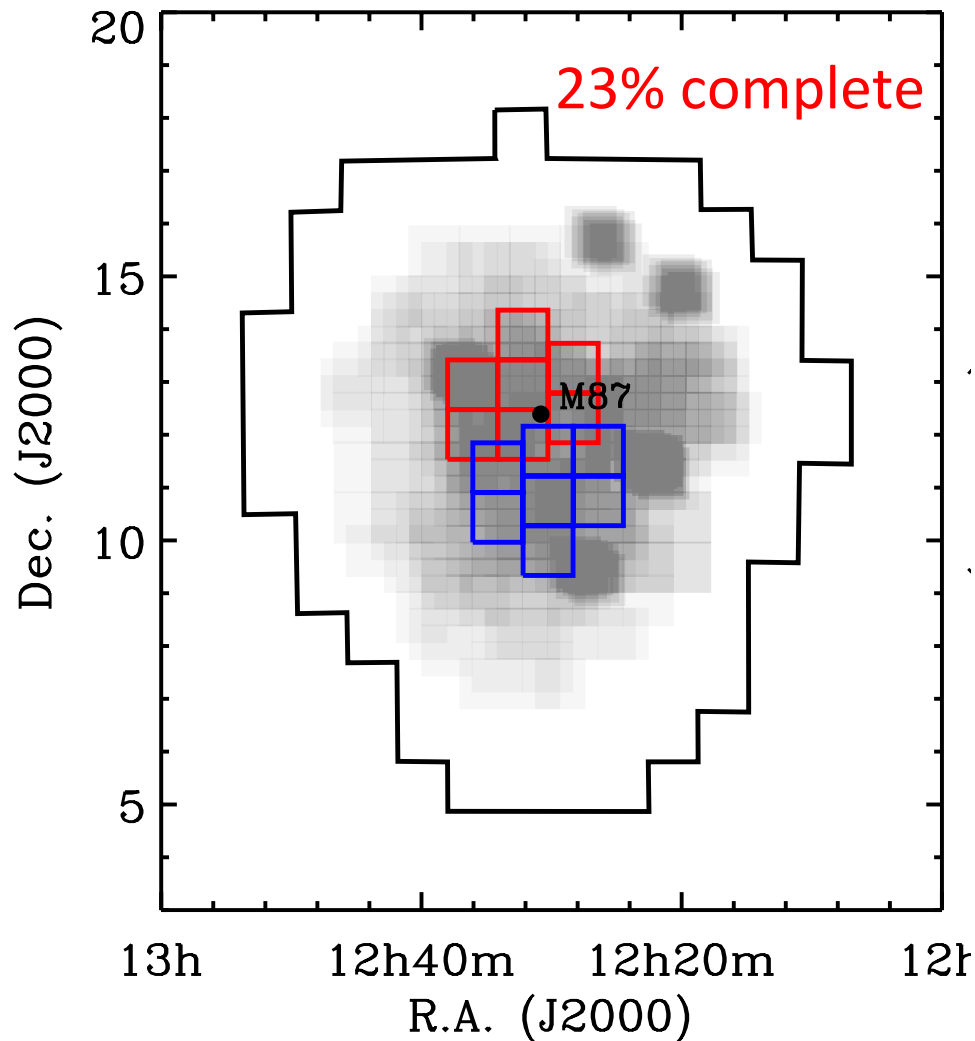
OBSERVING STRATEGY



- Late-type
- Early-type
- Green valley

Black contours: X-ray
(ROSAT)

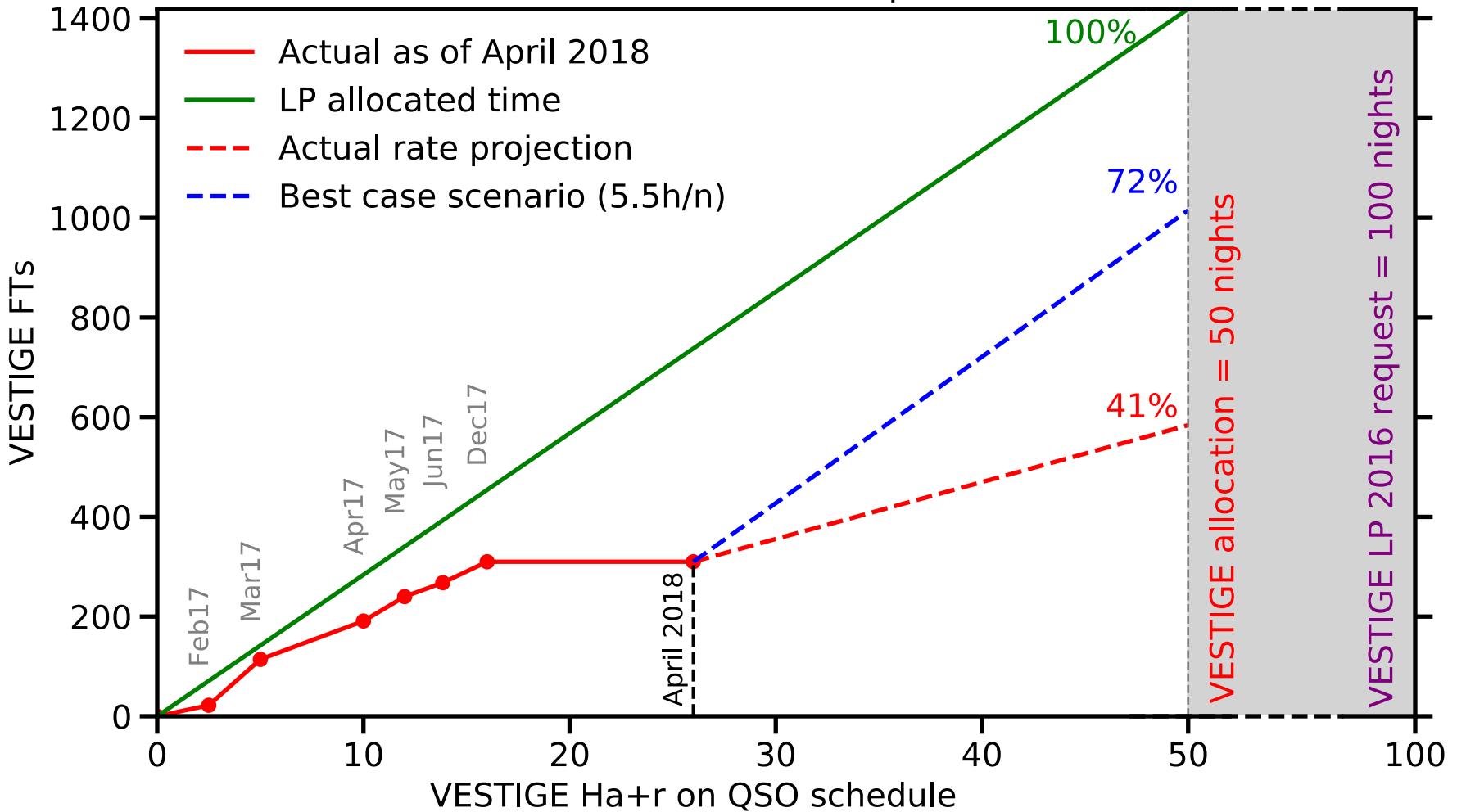
STATUS AFTER 2018A



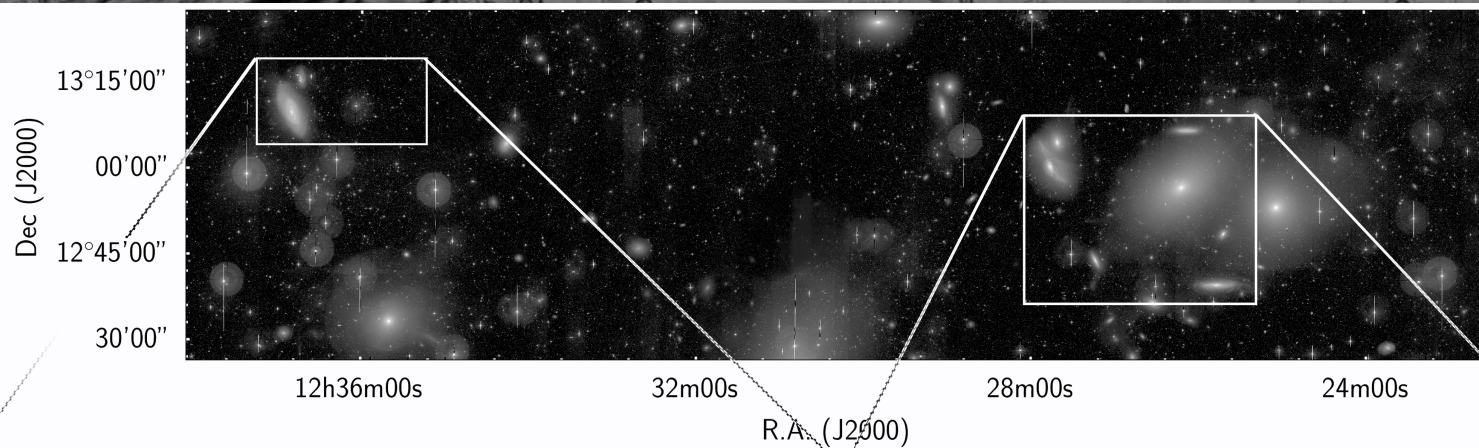
Boselli et al. 2018

STATUS AFTER 2018A

VESTIGE realized observations & predictions



RESULTS: THE CLUSTER CORE

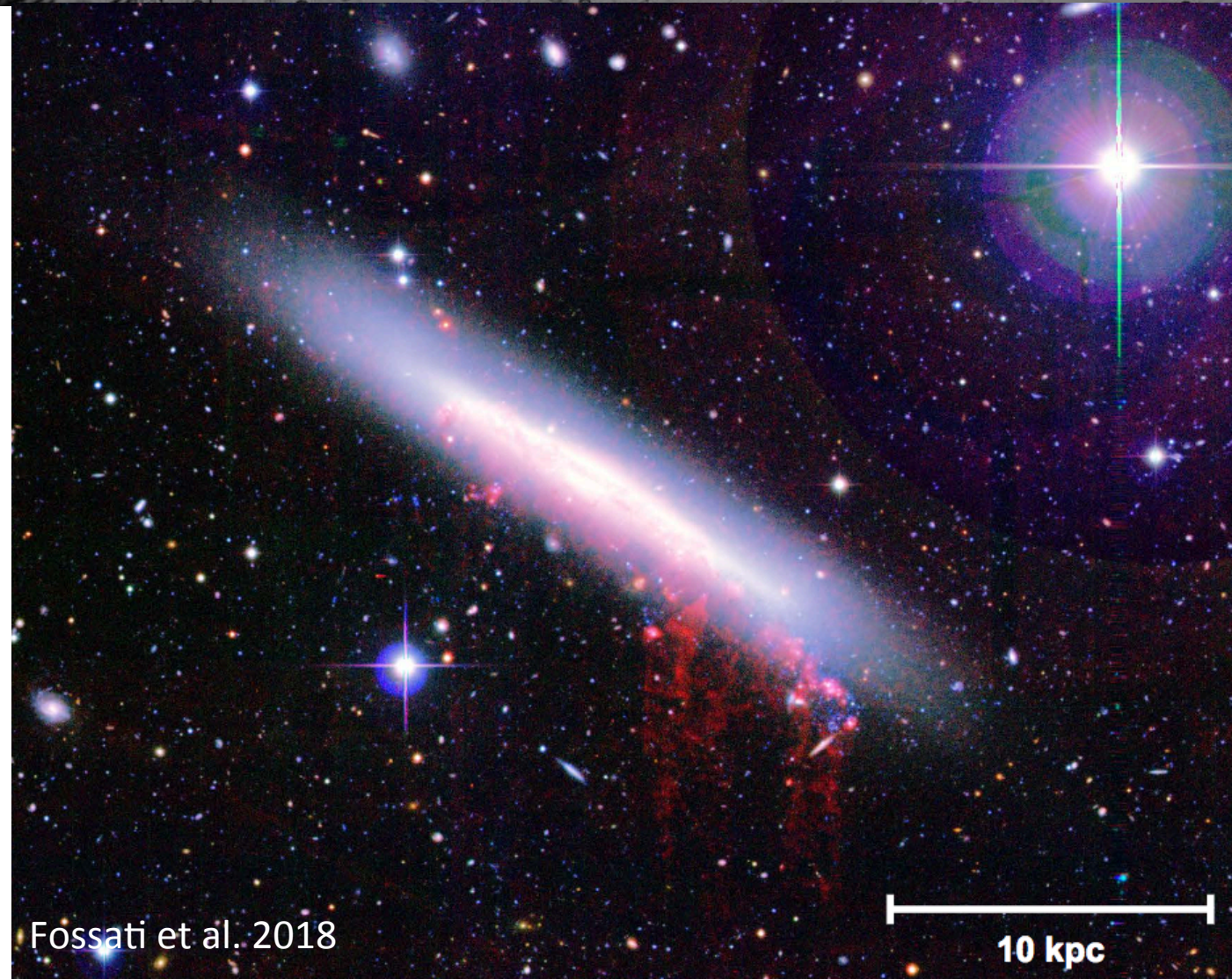


RESULTS: NGC 4330

Tails of stripped gas +
Rapid radial
quenching of the star
formation activity



ram pressure
stripping



Fossati et al. 2018

10 kpc

RESULTS: NGC 4424

Tails of HI stripped gas +
Rapid radial quenching of the
star formation activity

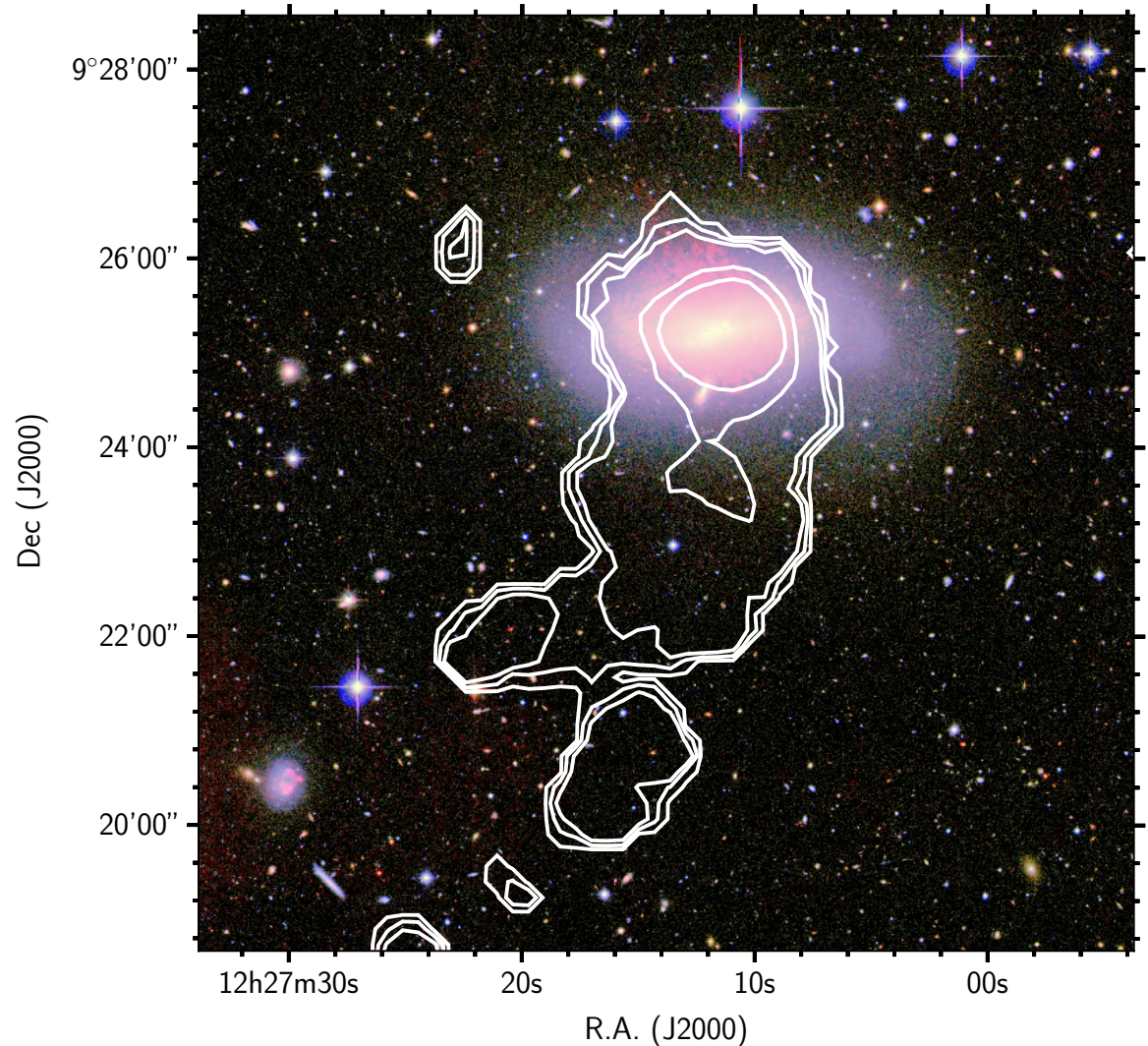


ram pressure stripping

Tail of ionised gas in the
opposite direction



**gas outflow from the central
starburst**





CONCLUSIONS

- The CFHT VESTIGE large program
- Excellent results in the detection of low surface brightness extended features formed after the interaction of galaxies with the surrounding environment
- Excellent angular resolutions

Stay tuned !

SCIENTIFIC OBJECTIVES

VIRGO SCIENCE

- The effects of the environment on galaxy evolution
- The fate of the stripped gas in cluster galaxies
- The star forming process in nearby galaxies
- The ionised gas emission in early-type galaxies
- The H α luminosity function of galaxies
- The H α scaling relation in galaxies
- The nature of dark galaxies
- The dynamical structure of the Virgo cluster
- The HII luminosity function of cluster galaxies
- Planetary nebulae and the origin of the intracluster light

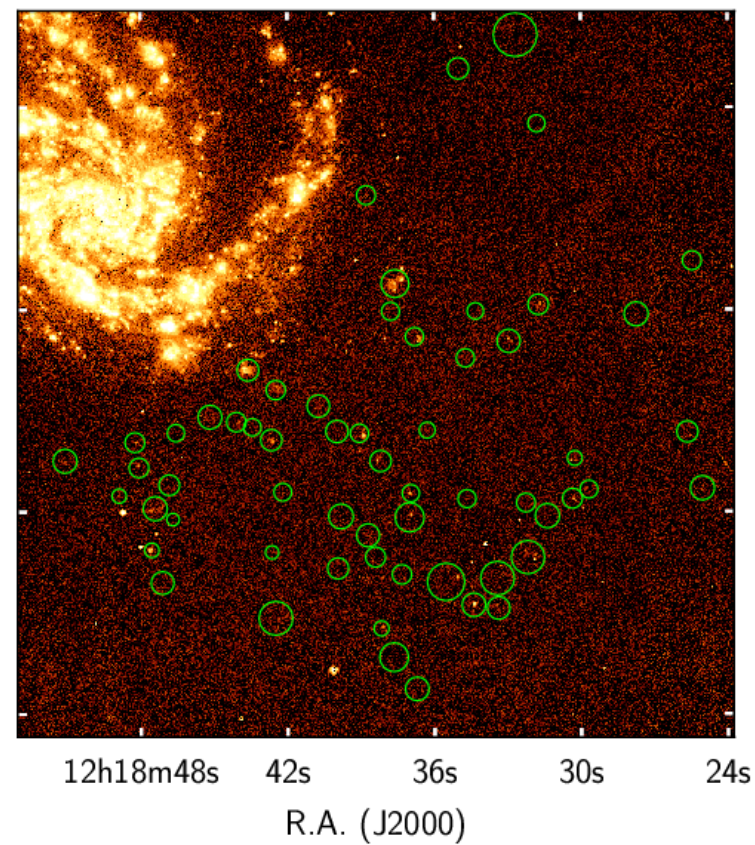
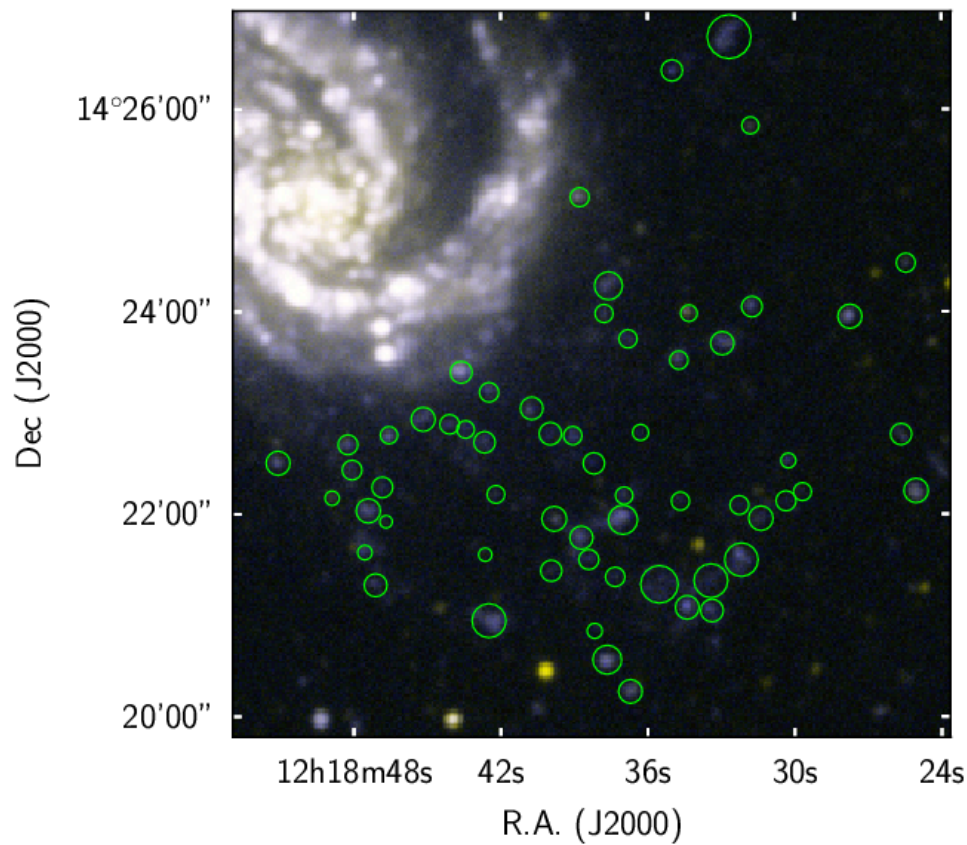
FOREGROUND SCIENCE

- The diffuse ionised emission of the Milky Way
- High velocity clouds, compact sources and Galactic fountains

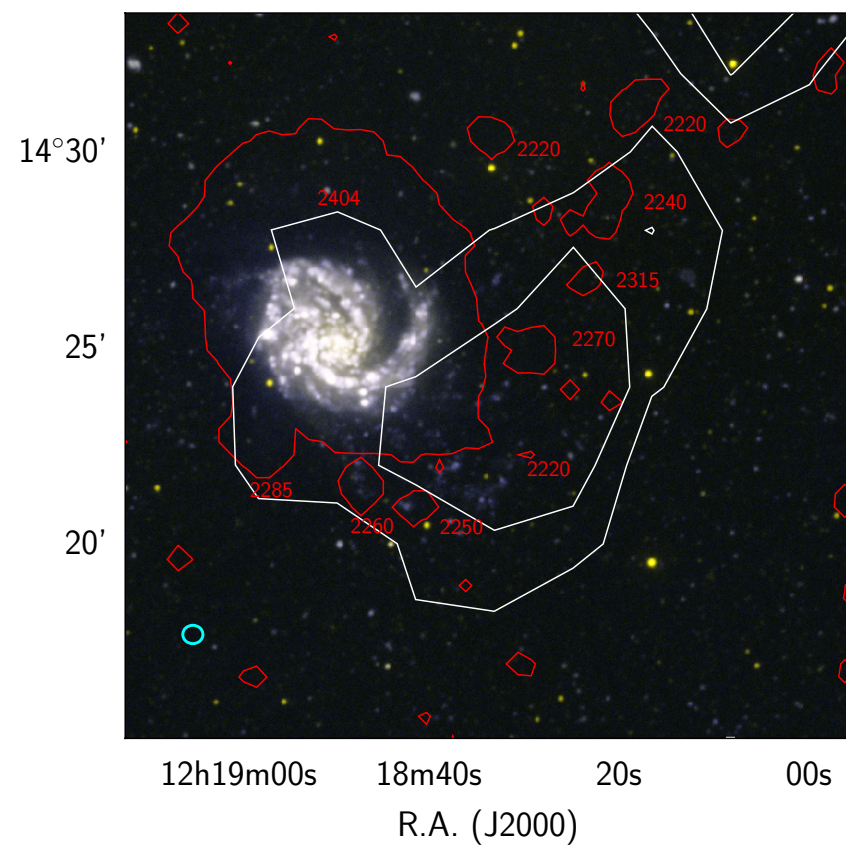
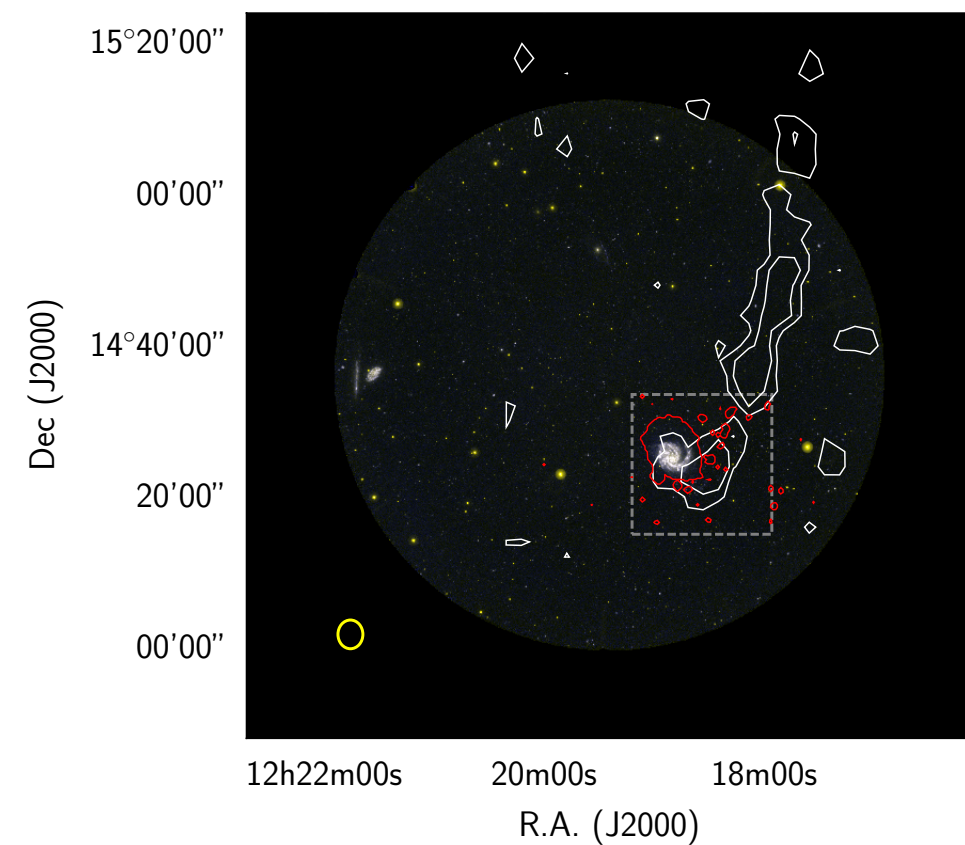
BACKGROUND SCIENCE

- High redshift emission line galaxies (Ly α , [OII], [OIII])
- QSOs

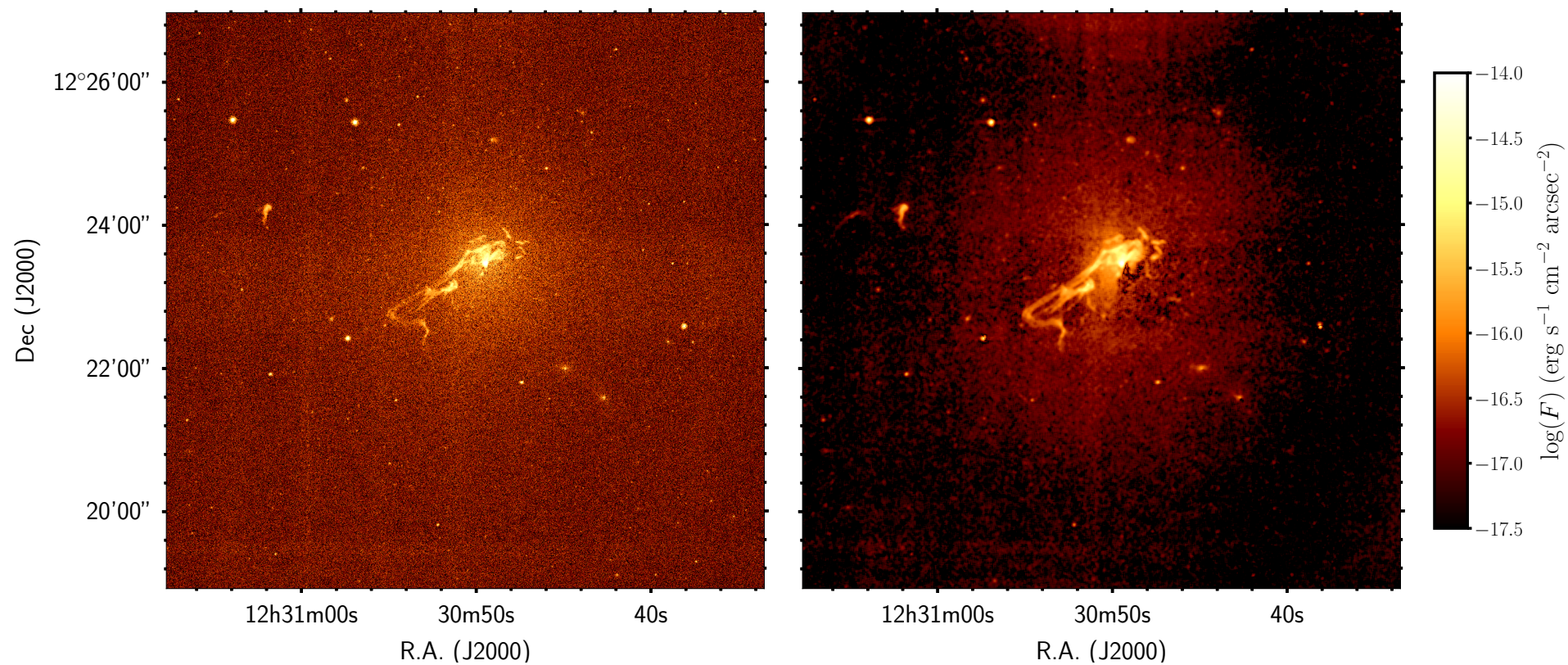
RESULTS: NGC 4254



RESULTS: NGC 4254



RESULTS: M87



Diffuse and extended H α emitting halo: gas ionised by evolved stars?

Boselli et al. in prep.