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INTRODUCTION

The compilation of imaging data in the GALEX Ultraviolet Virgo Cluster Survey (GUViCS) provides the means to make an exhaustive study of the UV properties of galaxies in the Virgo environment by surveying a wide range of UV magnitudes and galaxy types over the entire cluster area. Here, we will discuss the initial work that has been done on the UV based Virgo cluster catalog and recent preliminary measurements of the Virgo cluster's UV luminosity function from GUViCS. The new GUViCS data cover 94 pointings in the area of Virgo and achieve depths similar to GALEX MIS data (~1.5 ks). In combination with archival GALEX/Virgo observations we have complete cluster coverage of ~120 square degrees in the near-UV (2316Å) band, and coverage of ~40 square degrees of the cluster in the far-UV (1539Å) band in a combination of AIS, MIS, and DIS depths. These UV data are also complemented by several recent multiwavelength surveys of Virgo, all of which cover a majority of the cluster area from submm to optical bands (i.e. ALFALFA, HI, HeViCS, NGVS). We present the preliminary Virgo UV luminosity function as it compares to other local clusters, the field, and the central 12 deg² region of Virgo. The cluster luminosity function is vital for testing models of galaxy evolution as it provides a benchmark of information on the mechanisms driving star formation in dense galaxy environments in the local universe.

Data Reduction & Photometry

EXTENDED VCC SOURCES

- Determined UV detections of Virgo Cluster Catalog (VCC) sources (Binggeli et al. 1985) within entire GUViCS dataset
 - VCC comprises majority of sources in cluster (2096 total, 1753 in Virgo)
- Only VCC galaxies with GALEX pipeline detection within their optical B-band apertures were kept (2005 galaxies)
- Deepest NUV and FUV (if available) image for each matched VCC source was selected
- Visually inspected all VCC photometry apertures
 - Initial optical aperture was increased if it did not appear to contain all the extended UV emission of a galaxy
 - Compared UV images with Next Generation Virgo Cluster Survey (NGVS; CFHT) deep optical imaging (currently covers ~70deg² of Virgo) to confirm extended apertures do not intercept nearby galaxies and to remove spurious UV detections (comparing with NGVS is critical due to low resolution of GALEX (i.e. 4.2" in FUV; 5.3" in NUV))
 - Identified and masked stars in apertures using SIMBAD and SDSS databases
- Background measured in several small ~7.5" circular DS9 regions placed within an annulus extending 60pixels (1.5') from edge of each galaxy aperture
 - Regions visually inspected and manually shifted to an alternate position if they intercepted any sources surrounding the galaxy
- Measure integrated magnitudes with FUNTOOLS program in DS9 regions
 - If a P.A. was not available for an object, a circular aperture with radius = semi-major axis was used instead
- Integrated FUNTOOLS AB mags were compared to asymptotic AB mags from the GALEX/Herschel Reference Survey (HRS) catalog (Cortese et al. 2012, *submitted*). Integrated mags were found to be in good agreement
 - Ave. diff. = -0.08 in NUV + FUV with $\sigma = 0.12$ and 0.14, respectively
- Keep only VCC sources with distances in Virgo:

Final GUViCS/VCC catalog has: **1025 NUV sources**, **491 FUV sources**

VCC (in Virgo) Galaxy Type (Binggeli et al. 1985)	GUViCS NUV detects	GUViCS FUV detects
dE + dS0 (1108)	47%	8%
E (46)	93%	74%
S0, S0a-S0/Sa (81)	93%	69%
Sa,Sab,Sb,Sbc,Sc, Sd,Sd, S (dS) (186)	94%	86%
Sdm-Sd/Sm,Sm,Im (145)	77%	53%
peculiar (4)	100%	100%
BCD (56)	95%	91%
dIm/dE, ? (121)	39%	19%

POINT-LIKE SOURCES + NON-VCC SOURCES

- Combined all GUViCS pipeline catalogs (PCs) taking deepest available entire GALEX field, or section of GALEX fields, over the Virgo coverage area
 - Only consider central 0.5 deg radial area of each field to avoid artifacts
 - Removed all PC sources within VCC apertures and matched to bright stars from SIMBAD database
 - Used NGVS star/galaxy classifier to further remove point-like PC sources
 - Probabilities based on curve of growth algorithm by A. McConnachie
 - Made cuts in GALEX PC MAG_AUTO based on limiting 5 σ mag of AIS, MIS, DIS (Morrissey et al. 2007)
 - Remaining # sources in catalogs: **NUV=1,312,285**, **FUV=253,397**
 - For remaining sources, retrieved further star/galaxy classifications, redshifts, and optical magnitudes via SQL search in SDSS DR7 database
- Only pipeline sources with SDSS $z_{spec} < 0.01167$ are included, here, in the preliminary luminosity function (LF) of the Virgo Cluster

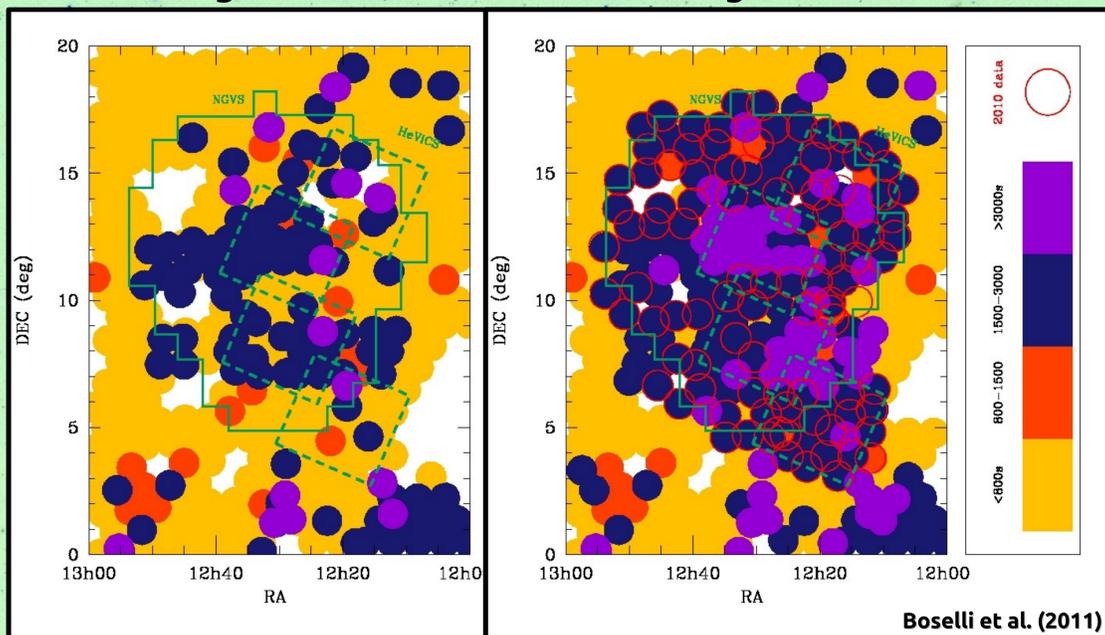
GUViCS CATALOG WORK-IN-PROGRESS

- Classify remaining GUViCS-to-SDSS matches as cluster or background sources via surface brightness vs. M criteria (Binggeli et al. 1985)
- Match catalog with NED to find further z_{spec}
- Derive asymptotic magnitudes, radial profiles, and parametric and non-parametric morphological information for the final UV based Virgo Cluster catalog

FINAL CATALOG WILL BE AVAILABLE FROM THE GUViCS
WEBSITE VIA ACCESS REQUEST TO THE MAIN TEAM

GUViCS COVERAGE of the Virgo Cluster Area

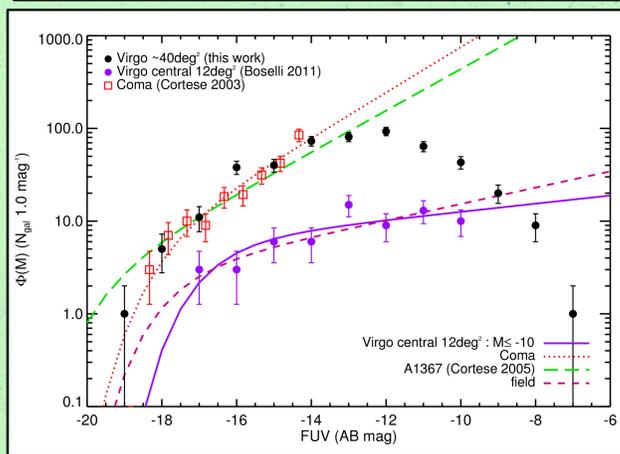
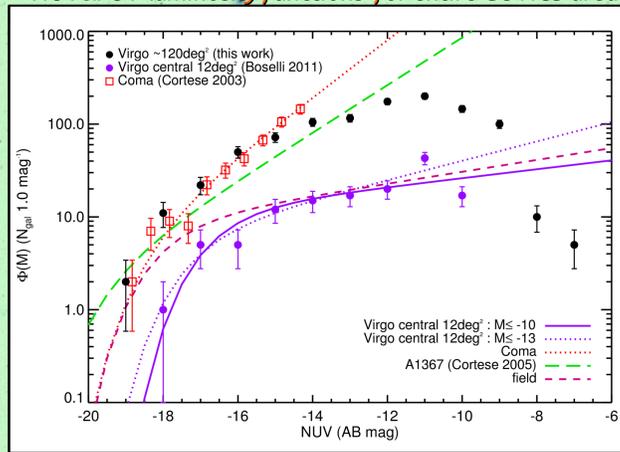
FUV ~40deg² NUV ~120 deg²



Boselli et al. (2011)

GUViCS Project Website: <http://galex.oamp.fr/guvics/index.html>

NUV&FUV luminosity functions for entire GUViCS area



Preliminary Luminosity Functions

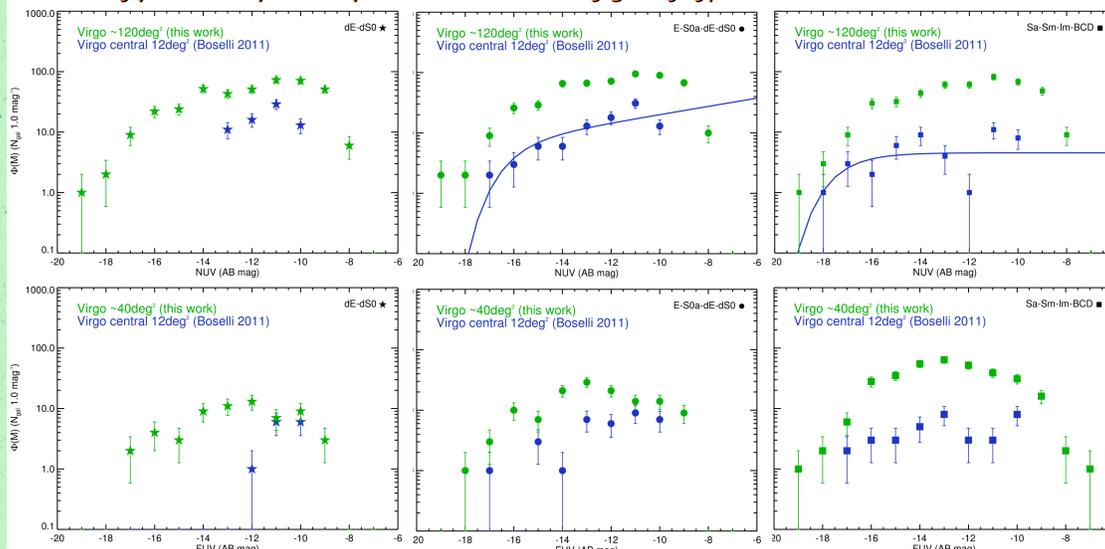
LEFT:

- Total sources in NUV LF = 1248 galaxies
- Total sources in FUV LF = 612 galaxies
- Absolute magnitudes (M) have been calculated with selected distances depending on VCC object cluster location as determined by Gavazzi (1999)
 - If source is from SDSS only, 16.5Mpc is used
- SOME CAVEATS (i.e. future work) INCLUDE:
 - We have not yet applied a correction for completeness to the sample -> may account for drop at faint end
 - Need to make a statistical correction between sources with and without z in each magnitude bin (Cortese et al. 2003)
 - The central 12 deg² LF has only ~8% non-VCC sources in NUV and ~9% in FUV; while total cluster LF has ~18% in NUV and ~20% in FUV. These additional non-VCC sources in the total cluster LF could partially account for the large differences between these two functions at the faint end. We plan to investigate this.

BELOW:

- Late-type galaxies have a large discrepancy between LF shapes and number of sources
 - Likely due to morphology-density segregation effect in cluster (i.e. more late-types in cluster periphery)
- Early-type galaxies agree in functional shape of the LF between entire cluster measurement and central 12 deg²
 - Suggests there is not much evolution in luminosity function for early-types out the cluster periphery
- Dwarf LF comparison shows these galaxies tend to populate the outer regions of the cluster
 - also, very few FUV detections

Luminosity functions of GUViCS/VCC sources binned by galaxy type



REFERENCES & ACKNOWLEDGEMENTS

• Binggeli, B., Sandage, A., & Tammann, G. 1985, AJ, 90, 1681 • Boselli, A., Boissier, S., Heinis, S., et al. 2011, A&A, 528, 107 • Cortese, L., Boselli, A., Gavazzi, G., et al. 2005, ApJ, 623, L17 • Cortese et al. 2012 (*submitted*) • Gavazzi, G. et al. 1999, MNRAS, 304, 595 • Morrissey, P., Conrow, T., Barlow, T. et al. 2007, ApJS, 173, 682 2007; We are grateful for the funding of this work by the CNRS/ANR VIRAGE grant and to the GALEX Guest Investigator program for granting us observation time for this work. We are also grateful to the NGVS collaboration.