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TRANSITION DWARF GALAXIES AND THE MORPHOLOGY-DENSITY RELATION IN NEARBY GROUPS OF GALAXIES

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ABSTRACT

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Subject headings: galaxies: dwarf — galaxies: groups: individual: Local Group, Sculptor, Centaurus A, M81, Canes Venatici — galaxies: evolution

1. INTRODUCTION

Dwarf galaxies are traditionally separated in two classes, the gas-poor early-type dwarfs (dwarf ellipticals, dEs, and dwarf spheroidal galaxies, dSphs) and the gas-rich star-forming dwarf irregular galaxies (dIrrs). Transition dwarf galaxies are defined as dwarf galaxies that show characteristics of both classes. They have been known to exist for a very long time, since (van den Bergh (1959)) discovered DDO210 and Pegasus in the Local Group and classified them as "mixed-morphology" dwarfs. In the past transition dwarfs have been classified as such based solely on their optical morphology, usually based on having the appearance of an underlying low-surface brightness smooth and symmetric red component (such as expected from a dE) superposed with young blue stars or knots of star formation. This sort of classification has entailed a lot of subjectivity, with the consequence of lack of agreement between authors. Transition dwarfs are found to have a much lower star formation rate for their absolute magnitude and HI mass than normal dIrrs. Many authors now classify a dwarf as a transition dwarf if it contains cold gas (HI) like dIrrs but has no, or only very weak, star formation as traced in Hα (Mateo 1998; Grebel et al. 2003; Skillman et al. 2003a; Côté et al. 2009; Weisz et al. 2011; McQuinn et al. 2015). They are believed by many to be the "missing link" between dIrrs and dEs (Heisler et al. 1997; Knezek et al. 1999; Lianou et al. 2013)), and that they represent dwarfs in the midst of a transformation from dIrrs to dEs, through some mechanism that is able to remove the cold gas, drain the angular momentum, and heat the stellar disk (e.g. Skillman et al. (2003a)). But whether they indeed represent a real evolutionary link between these two types of dwarfs is still controversial. Because dIrrs are known to have long periods (100 to 500 Myrs) of enhanced star formation separated by short quiescent epochs when the star formation is low (referred to as "gasping"; Tosi et al. (1991), McConnachie (2012) suggest that perhaps the distinction between a dIrr and transition dwarf might merely reflects the moment we happen to be observing it. In other words, transition dwarfs might simply be dIrrs that happen to be in their temporary quiescent phase.

However, we know that the environment probably has a strong influence on the evolution of dwarfs, and the clear morphology-density relation seen in the Local Group is a striking example. Dwarf spheroidal galaxies are preferentially found within $\sim$ 300 kpc of the normal galaxies (the Milky Way and M31), while dIrrs are more widely spread (van den Bergh 1994a). This same morphology-density relation also holds in the nearby groups Sculptor and Centaurus A (Côté et al. 2009). Interestingly, in both of these groups as well as in the Local Group, the transition dwarfs are found at distances from large galaxies on average in-between, further out from the larger galaxies than the early-type dwarfs, but closer to them than the overall dIrrs. The origin of this morphology-density relation is thought to be the result of quenching of star formation as dwarf galaxies become satellites of larger systems (similar to the quenching seen in normal galaxies entering higher redshift clusters, e.g. Gomez et al. (2003)). In small groups, galaxies such as the Milky Way are likely surrounded by a hot gas halo which is able to quench star formation of dwarf galaxies falling within their virial radius (Grcevich & Putman 2009). The quenching can happen either by "strangulation" because there is no more fresh gas to accrete (Larson et al. 1980), or by "ram-pressure stripping" (Gunn & Gott 1972) that removes the cool gas from the dwarf galaxy as it plows through the large host's

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gas halo. Closer encounter with the host can further affect the dwarf galaxy morphology through "harassement" (Moore et al. 1996), which can transform a late-type dwarf into an early-type one. A dynamical transformation can also be achieved through "tidal-stirring" (Mayer et al. 2001a), where repeated tidal shocks partially strip the halo and disk of a dIrr to reshape it into a dE/dSph. There are thus many credible scenarios to effectively transform a dIrr into a dSph, in which an intermediate stage, or incomplete process, would be the observed transition dwarfs.

In this context it is thus of interest to survey the most nearby groups of galaxies to find and locate these transition dwarfs. There are now excellent distance estimates for many dwarfs in nearby galaxies thanks to the Tip of the Red Giant Branch (TRGB) method applied to HST Color-Magnitude-Diagrams (CMDs), for example through the ACS Nearby Galaxy Survey (ANGST, Dalcanton et al. (2009)). With these distances, the Morphology-Density relation can now be investigated with 3D accuracy in some of the nearest groups. This gives us more opportunities to study the location of transition dwarfs amongst other dwarfs within these groups. The study of transition dwarfs in nearby groups can bring clues to their nature and thus, indirectly to the nature of dSphs too. In this study we will concentrate on transition dwarfs in the Local Group, the Sculptor, Centaurus, M81 and CanVen Groups. In our previous paper we concentrated on the transition dwarfs of the Sculptor and Centaurus Groups (Skillman et al. 2003a; Côté et al. 2009). Here we will first try to identify new transition dwarfs amongst the faintest members of these groups, then study the morphology-density relation for all the nearby groups listed above. In Section 2, we will present the Gemini H_α observations of a sample of nearby groups dwarfs and discuss their classification as transition dwarfs. Section 3 will present an overall comparison of star forming properties of dwarf galaxies in all these nearby groups and their population of transition dwarfs. Section 4 will present the Morphology-Density relation for the nearby groups, and discuss the implications for transition dwarfs.

2. OBSERVATIONS

2.1. *Gemini Observations*

Eight dwarf galaxies from the Sculptor and Centaurus A groups previously identified as transition dwarf candidates, based on their morphology, were imaged at the Gemini-South Telescope with GMOS-S in queue-observing (program GS-2007B-Q-227).The data were all obtained over a period of two weeks in July 2007. The GMOS-South detector array consisted, at the time, of 3 EEV CCDs of 2048 × 4068 pixels detectors, with pixel size of 0.073″, which were binned 2 × 2 for these observations. Each dwarf galaxy was observed 4 times 300 seconds with the H_α narrow-band filter (centered at 656 nm and with a FWHM of 7 nm), followed by 4 times 300 seconds with the off-band H_α continuum filter (centered on 662 nm with FWHM of 7 nm), with each sets of 4 exposures following a dithered pattern of up to 5″or 6″. This is necessary to recover the regions in the gaps between the three CCD chips which are about 39 unbinned pixels wide. Data were acquired under observing conditions of thin cirrus but with variations of less than 15%, and with seeing ranging from 0.48″to 0.95″. Some Stone and Baldwin standard stars were also acquired (LTT377 and LTT7379, Stone and Baldwin (1983)), as well as twilight flatfields for both filters. The nine observed dwarf galaxies are listed in Table 1.

2.2. *Data Reductions*

The data were reduced using mostly the Gemini IRAF package. Mean bias frames for the bias subtraction were created by combining all usable bias frames of each of the GMOS-S observing runs. A bad pixel mask was constructed using the Quartz-Halogen flats, and the twilight flats were used for flatfielding the data. The four exposures in each filter were registered and co-added. The co-added off-band image was then smoothed with a Gaussian so that in the final image the point-spread functions matched as closely as possible those in the H_α image. This continuum image was then scaled appropriately, and then subtracted from the H_α image.

H_α fluxes were obtained by integrating the emission within all the detected HII regions. Errors in fluxes are up to 20% due mainly to absolute flux calibration uncertainties. Also, no correction for [NII] contamination were applied to the fluxes, dwarf galaxies have very low nitrogen abundances (see, e.g., Skillman et al. 2003b) but this introduces an additional ∼6% flux uncertainty. H_α luminosities were then computed from the H_α fluxes using the distances of Table 1, and using a Galactic extinction correction following $A(H_\alpha) = 2.32E(B-V)$ (Miller & Hodge 1994), with reddening values from Schlegel et al. (1998). These H_α luminosities were then converted to current star formation rates (SFRs) following Kennicutt et al. (1994), with:

$$SFR(total) = \frac{L(H\alpha)}{1.26 \times 10^{41} erg\ s^{-1}}\ M_\odot\ yr^{-1} \quad (1)$$

which has been derived for normal spiral galaxies, using a modified Salpeter IMF. No corrections were made for internal extinction (which are necessary for normal spirals) since these are very small in low metallicity dwarf systems. These SFRs are tabulated in Table 2. Four dwarf galaxies were detected, and four were not, with detection limits below 0.53×10^{-5} $M_\odot$ yr^{-1}. Figure 1 shows the H_α-band images (left panels) and the final continuum-subtracted H_α images (right panels) of the detected dwarf galaxies.

Some of our galaxies have previous H_α measurements in the literature. Both NGC59 and ESO407-G18 were detected in Kennicutt et al. (2008) survey, and our values agree very well with them within errors: $11.7 \pm 1.5 \times 10^{-3}$ and $4.3 \pm 1.9 \times 10^{-5}$ $M_\odot$ yr^{-1} for SFR respectively, scaling Kennicutt et al. (2008) published values to the same new distances that we used (listed in our Table 1). For ESO384-G16 though there is a large discrepancy between the flux detected here (3.91×10^{-15} and that of Bouchard et al. (2009) which is more than 3 times higher (13.6×10^{-15}). We do not think that this is due to uncorrected heavy attenuation on the night of our observations because the same standard star was used on the other observing nights and the counts are consistent. As for Bouchard et al. (2009) 's value, in the comments on individual objects (their section 2.6.4) the authors concede that the 27.3×10^{-15} detection for ESO219-G10 (even higher than ESO384-G16's) could be entirely interpreted as a spurious detection, because "different seeing conditions in the off-band and on-band images is likely to have altered our capacity of making a good continuum estimate". It is thus possible that the same caveat applies to their ESO384-G16 observations, which would explain the discrepancy with our number. Note that whether their value or ours is closer to reality this does not change the conclusions below on the classification of ESO384-G16 as a transition dwarf or not. This could also explain another discrepancy, this time with ESO540-G32 for which they report an unusual unresolved single peak of emission of $0.8 \pm 0.3 \times 10^{-5}$ M$_\odot$ yr^{-1} near the center while our data show a non-detection to a level of 0.22×10^{-5} M$_\odot$ yr^{-1}. This could have easily been produced by a leftover core because the off-band and on-band images were not smoothed to the same point-spread functions (a step which was performed on our data, see above). More data would be needed on this object to settle this question, but for the remainder of the paper our non-detection value is adopted. The HII regions in the detected dwarf galaxies have a very wide distribution, sometimes being found exclusively on the outer edges of the optical disks, as is very commonly the case in dwarf galaxies (eg. Brosch et al. (1998)). We discuss below which of our observed dwarfs are classified as transition dwarfs or normal dIs based on our results.

3. TRANSITION DWARFS IN NEARBY GROUPS

The SFRs of our observed dwarfs are very low relative to normal spiral galaxies, and either comparable to the low levels of star formation typical of dIs or even lower. Normal galaxies have SFRs that correlate with their luminosity and the same correlation continues to lower luminosity for dIs. In other words the SFR per unit luminosity remains about the same from giant to dwarf galaxies. From Kaisin et al. (2007) sample of 154 Local Volume galaxies with morphological type $T > 0$, bright galaxies of M$_B = -20$ have on average a log SFR ~ 0, while galaxies of M$_B = -15$ have log SFR ~ -2 and dwarf galaxies of M$_B = -10$ have log SFR ~ -4. Amongst our sample of eight dwarf galaxies four were not detected in Hα (HIPASSJ1321-31, ESO410-G05, ESO540-G30 and ESO540-G32), two were detected but at much suppressed levels of SFR compared to dIs of the same luminosity (ESO384-G16, ESO407-G18), and two were detected with normal SFRs for their luminosity (HIPASSJ1337-39, NGC59). All except the last two are therefore classified as transition dwarfs.

The four Sculptor Group dTrans identified here can be added to the other four cases already known in the group: SDIG, DDO6, UGCA438, and ESO294-G10. And in the Centaurus Group our two dTrans add to the three previously identified: ESO269-G58, UGCA365 and UKS1424-460 (Côté et al. 2009). In the Local Group the following 6 galaxies have been previously classified as dTrans: LGS3, Antlia, DDO210, Pegasus, Phoenix (Mateo 1998) and Leo T Irwin et al. (2007).

There are no previous study that has focused on dTrans in the M81 or Canes Venatici Groups, so we list in Appendix 1 all their dwarf members (of all types) as well as their star formation rates and neutral gas content. Their SFRs and HI masses are what is used to determine their dTrans nature or not, following the same criteria as in the studies quoted above, which were based on (Mateo 1998) convention that dTrans are those with detectable amount of HI but no significant recent star formation as measured by Hα. We find a total of XiXXX dTrans in M81 () and XXXXX in Canes Venatici (), they are indicated in Table 1.

Thus dTrans galaxies are ubiquitous in all nearby groups, representing typically less than XXX15% of the number of normal dIs members. They are found in every type of groups, the quiescent ones filled with late-type spirals (like the Sculptor Group), to the "active" groups filled with early-types and active galaxies such as the Centaurus A Group.

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX Boyer et al 2015 ApJS;"The dTrans galaxies are typically gas rich, but show no evidence of current massive star formation through the presence of Hii regions. THe nature of transition galaxies is a matter of debate. Many dTrans galaxies are consistent with dIrr galaxies that are forming stars at such a low rate that the absence of Hii regions is consistent with stochastic variations. However, some show evidence for reduced gas mass fractions and apparently lie between the dSphs and dIrrs in the morphologydensity relationship (e.g., Skillman et al 2003, Weisz et al 2011)."

4. DISCUSSION

XX FIgure 2: SFR or SFR/LB versus Distance from spiral

XX Figure 3: MHI/LB versus DIstance from spiral

XX FIgure4: HIstogram dI/trans/dE versus Distance

H$_\alpha$ traces the young gas (XX Myears) so we are finding the trans dwarfs that have just recently been affected by strangulation. (if looked for lack of uv would be from stars xx older, and from stellar pops even older) i.e.: strangulation might have happened a very long time ago - by that time dwarf can move away (given typical velocity) away from central galaxy affecting them.

Pop gradients with higher metallicity more centrally concentrated is seen in many LG dwarfs see list of refs Habeck, Kirby etc in Lianou 1211.3170 weisz 211 says sfh of lg dwarf similar cumulatively but it is the recent sf that is different: early epoch dominated by internal processes, later phases by influenced by environment. MHI goes up vs distance (lianou 1211.3170).

Mpc scale pancakes and filaments do not develop typically until z=2 benitez navarro 1211.0536

Nice review by Grebel 1103.6234: morphology-density relation in groups: HI mass -radius relation, e.g. HI masses from dwarfs $<$ 270 kpc from MW,M31 are $< 10^4 M\odot$ (Grcevich & Putman 2009). In the LG no two dwarf share the same SFH (not even within the same morphological type). SFR and SFH in LG and nearby groups do not show a clear correlation with distance from closest primary (weisz 2011, cote 2009, lianou 2010). Typically extended episode of SF, leading to large abundance spreads (one dex in Fe/H or more). dsph typically too metal-rich for their luminosity compared to late-type dwarfs (might make it difficult to turn dirr into dsph; maybe low-mass trans types have the right metallicity). Population gradients in many but not all dwarfs both early and late types. Usually the metal-rich younger pop is more centrally concentrated.

Morphology-density relation: the higher the density the more efficiently the infalling spirals and irr transformed into dEs. for example conselice 2001 find number of des in virgo is 3 times than expected from just adding groups to cluster (lisker grebel 2006).

5 dIrrs from CenA from HST: looking at recent level of activity (0.5 to 1 gyr, dwarfs in denser part of the group seem to have had their sf quenched while dwarfs in outskirts show wide range of sr rates (crnojevic grebel 1203.5817) Importance of external processes in shaping SFH of dwarf galaxies.

Resonant stripping (d'Onghia et al 0907.2442) to transform a dwarf disk into dsph. Blowout by feedback from SF does not work because DM halo is too large 10^8 $M_\odot$ for SN-driven winds to remove gas. Other: tidal-stirring + ram pressure but dwarfs need to orbit very close to giant. From numerical exp: after 2 billion years 80% of stars are stripped, caused by resonant stripping.due to resonance between spin angular frequency and angular freq of orbit.

Tidal stirring: strongest and most compete transformation occur with short orbital times and small pericenter distances (kazantzidis, lokas, mayer 1009.2499) Tidal stirring: if density profile of diir progenitor is more corelike than a single pericentric passage can induce dsph formation and disky dwarfs on low-eccentricity or large pericenter orbits to be able to transform into dsph kazabntzidis mayer 1302.0008. Bar-like structure should be common in less evolved dwarfs as the bar stage is one of the longest phases in the transformation process.

At 250kpc MW coronal halo gas is order of mag too low to remove HI gas via ram-pressure. need feedback+tidal+ram (Nicholds, bland-hawthorn 1102.4849).

There are also clues from the kinematics of dEs that supports the idea that they might indeed be the remnants of transformed disk galaxies. Beasley et al (0903.4364) looked at the globular cluster system kinematics of 3 Virgo dEs and found that they have $V_{rot}/V_{los} > 1$.

Weisz 2008 0809.5059: recent SFH of M81 dirs: no clear trend vs faint to bright, or LG vs M81 (SF of dir must be dominated by stochastic processes). Weisz 2011: there is no difference between SFHs of dIrr and dSph actually similar over most of cosmic time, only in past few gyrs, and particularly las 1 gyr, that sfhs differ. sfh dir and trans no difference.

From galaxy imaging in 23 groups at z=0.06, rasmussen mulchaey 1208.1762, SF members are suppressed relative to the field out to an average radius of R=1.5 Mpc (2 R200), suppression is stronger in more massive groups.same bahe balogh 1210.8407 depletion of hot and cold gas is seen as far as 5 r200.

At faint end H_α is underpredicting total SFR from FUV. By SFR-0.003, average H_α to FUV is lower by factor 2. new calib logsfr vs LHalpha (Lee, Kennicut, 0909.5205)

dIrrs in denser environment and closer to dominant galaxies have had lower SFRs in the last 500Myr (Crnojevic et al 1009.4198).

dIrrs in denser region have a much lower MHI/SFR than isolated ones (crnojevic, grebel 1103.3707)

MHI mass does not correlate with their present day distance from main galaxy but MHI/Mbaryonic does (1203.5817) No correlation SFR with present-day distance to main galaxy fig2 (1203.5817).

H_α traces short-lived massive stars but at low values $< 10^-3M \odot /yr$ stochastic sampling of IMF affects use of H_α. longer-lived UV thus is preferable but has to be corrected for the effect of dust attenuation calzetti 1208.2997

From Weisz et al 2011 ApJ 739 :(1) the majority of dwarf galaxies formed the bulk of their mass prior to z 1, regardless of current morphological type; (2) the mean SFHs of dIs, transition dwarf galaxies (dTrans), and dSphs are similar over most of cosmic time, and only begin to diverge a few Gyr ago, with the clearest differences between the three appearing during the most recent 1 Gyr and (3) the SFHs are complex and the mean values are inconsistent with simple SFH models, e.g., single bursts, constant star formation rates (SFRs), or smooth, exponentially declining SFRs. The mean SFHs show clear divergence from the cosmic SFH at z ¡ 0.7, which could be evidence that low-mass systems have experienced delayed star formation relative to more massive galaxies. The sample shows a strong density-morphology relationship, such that the dSphs in the sample are less isolated than the dIs. We find that the transition from a gas-rich to gas-poor galaxy cannot be solely due to internal mechanisms such as stellar feedback, and instead is likely the result of external mechanisms, e.g., ram pressure and tidal stripping and tidal forces. In terms of their environments, SFHs, and gas fractions, the majority of the dTrans appear to be low-mass dIs that simply lack H emission, similar to Local Group (LG) dTrans DDO 210. However, a handful of dTrans have remarkably low gas fractions, suggesting that they have nearly exhausted their gas supply, analogous to LG dTrans such as Phoenix.

From de Looze 2013 mnras: Hershel Virgo cluster survey: "Dust scaling relations support the hypothesis of a transformation between infalling late-type galaxies to quiescent low-mass spheroids governed by environmental effects, with dust-to-stellar mass fractions for transition-type dwarfs in between values characteristic for late-type objects and the lower dust fractions observed in early-type galaxies. Several transition-type dwarfs demonstrate blue central cores, hinting at the radially outside-in removal of gas and quenching of star formation activity. The fact that dust is also confined to the inner regions suggests that metals are stripped in the outer regions along withthe gas."

see Adam Muzzin (gemini conf toronto 2015) about list of mechanisms and their sphere of influence eg: ram-pressure, strangulation etc in mid-redshift clusters

cite Boselli et al 2008, two papers about trans dwarfs inthe Virgo cluster check Boselli Gavazi 2014 AAReview for references on dtrans including in group environments

5. TO DO

LIST OF ALL the THINGS LEFT TO CHECK:

- check all table3 CanVen if some CanVen dwarfs NOW have good distances. (Sylvie doing the checks and updating the list) they should get into the histogram lists of alldi.tex, allteans.tex. check ugc8882 KK166 KKR25, they are all trans, but they are missing from alltrans.txt in canes Ven. check NED then add them to the list of dwarfs. Maybe they don't have a measured distance? (or did not have at the time?) alltrans.txt is only for those with distances. For CanVen , did we use uniform distances from Makarov 1305-3701 or not? (better to take best distances, even if not the same source for all)

- check Weisz 2011 Apj 743 he lists some M81 dwarfs as dtrans based on Angst data (check if same as ours).

-check if segue1 is in Local group sample (from the tables in typeHistogram it looks like it isn't)

-KDG61: is actually a dsph behind a M81 tidal HII region, according to Croxall et al 2009, eg: the HII region is NOT part of KDG61. Make sure it is not listed in the dI table.

- d0926+70 in M81 group listed as di/dsph by Chiboucas 2013 aj 146,5,126., check if trans selon mes criteres - one of the smallest dwarfs with recent SF known Mr=-9.7

-mention new detections of MW dwarfs by DEcam survey- but say distance estimates very bad, rest on 5 or 6 stars in CMD etc.so not trusting the distances.

This work made extensive use of the NASA/IPAC Extragalactic Database (NED) which is operated by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration. Thanks to our friends at Gemini for acquiring the queue data.

Facilities: Gemini (GMOS-S).

APPENDIX

M81 AND CANES VENATICI GROUP MEMBERS

In this Table we list the dwarf galaxies known to be members of the M81 and Canes Venatici Groups. We only list the objects that have had their distances estimated reliably (mostly by the TRGB method, and some even have cepheids or RRLyrae distances), and are therefore confirmed to be bona fide members of these groups. The columns of the Table give the following: (1) Name; (2) Coordinates; (3) Distance and error; (4) Morphological Type: for simplicity we only use four types of classes for the dwarf members, following (Mateo 1998),(Weisz et al. 2011) morphological classifications: for the early-type dwarfs dSph and dE (dwarf Spheroidals and dwarf Ellipticals), dI for all dwarf irregulars including Blue Compact dwarfs, and dTrans; (5) the ratio of the Star Formation Rate over the luminosity of the galaxy;(6) the ratio of HI mass to the luminosity of the galaxy; and (7) the references for, in order, the distance, the star formation rates and, if from a different source, the HI mass. (explain cutoff at 0.25 Mpc error, because that's about the size of the effect we expect to see in terms of distance difference between the different types of dwarfs)

TABLE 3
Dwarf Galaxies members of M81 and Canes Venatici Groups

Galaxy	RA-Dec (J2000)	Distance Mpc	Type	Log(SFR/L(B)) $M_\odot$ yr^{-1} $L_\odot^{-1}$	M(HI)/L(B) $M_\odot/L_\odot$	Refs.
			M81			
NGC 2366	07:28:54.6 69:12:57	3.11 ±0.09	dI	-9.45	1.78	3,4
UGCA133	07:34:11.5 66:52:47	3.1 ±0.05	dTrans?	-12.09	0.10	1,2
UGC4459	08:34:07.2 66:10:54	3.66 ±0.18	dI	-9.58	1.17	5,4
KKH 34				-10.89	0.93	
KKH 37				-10.56	0.68	
Holmberg II				-9.93	1.29	
KDG 52				-11.87	2.15	
UGC 4483				-9.63	1.68	
Holmberg I				-10.12	1.39	
BK 3N				-11.17	2.96	
A0952				-9.90	1.6	
Holmberg IX				-10.31	6.85	
NGC 3077				-10.25	0.31	
TheGarland				-8.80	6.14	
UGC 5423				-10.18	0.25	
IC 2574				-9.80	1.13	
DDO 82				-10.46	<0.02	
DDO 87				-10.33	1.17	
KDG 73				-11.15	0.97	
UGC 6456				-9.52	0.97	
UGC 7242				-10.49	0.7	
DDO 165				-10.74	0.82	
			Canes Venatici			
UGC 5427				-10.17	0.32	
UGC 5672				-10.15	0.22	
NGC 3274				-8.92	1.2	
UGC 6541				-9.36	0.22	
NGC 3738				-10.14	0.18	
NGC 3741				-9.72	4.07	
KK 109				-11.38	2.75	
DDO 99				-10.08	1.29	
BTS 76				-10.68	0.59	
NGC 4068				-9.87	0.81	
MCG 627				-11.0	0.21	
NGC 4163				-10.55	0.37	
NGC 4190				-10.02	0.81	

TABLE 3 — *Continued*

Galaxy	RA-Dec (J2000)	Distance Mpc	Type	Log(SFR/L(B)) $M_\odot$ yr^{-1} $L_\odot^{-1}$	M(HI)/L(B) $M_\odot/L_\odot$	Refs.
DDO 113				-11.86	0.28	
MCG 920				-10.16	0.83	
UGC 7298				-11.22	1.62	
UGC 7356				-11.45	11.48	
IC 3308				-10.09	1.86	
KK 144				-10.34	4.68	
UGCA 281				-8.95	1.26	
DDO 126				-9.85	1.82	
DDO 125				-10.60	0.46	
UGC 7584				-10.01	1.2	
KKH 80				-11.68	0.69	
DDO 127				-10.74	1.78	
UGC 7605				-10.09	0.66	
KK 149				-10.50	0.41	
UGC 7639				-11.08	0.34	
DDO 133				-9.91	1.58	
ARP 211				-10.04	0.35	
UGCA 292				-9.37	5.62	
NGC 4627				-12.84	0.05	
IC 3687				-10.10	0.95	
DDO 147				-10.32	2.82	
KK 166				-11.22	0.76	
DDO 194				-10.39	0.62	
KKR 25				-11.17	0.05	

Note. — References are: (1)Dalcanton et al. (2009), (2)Karachentsev & Kaisin (2007), (3)McQuinn et al. (2010), (4)Kennicutt et al. (2008), (5)Jacobs et al. (2009), (6) ...

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TABLE 1
Dwarf Galaxies (transition dwarfs candidates) observed in Hα

Galaxy Name	R.A. (J2000)	Dec. (J2000)	$V_\odot$	D (Mpc)	M(B)	Ref.
		Centaurus A				
HIPASS J1321-31	13:21:08.2	−31:31:45.0	492	5.2 ±0.12	−11.5	5,10
HIPASS J1337-39	13:37:25.3	−39:53:48.49	492	4.80±0.2	−13.89	4,6,11
ESO 384-G016	13:57:01.4	−35:19:59.0	561	4.43±0.03	−15.09	2,5,12
		Sculptor				
NGC 59	00:15:25.10	−21:26:40	362	5.3±1.1	−15.3	1,9
ESO 410-G005	00:15:31.56	−32:10:47.8	160	2.01±0.09	−11.67	2,3,13
ESO 540-G030	00:49:20.96	−18:04:31.5	224	3.33 ±0.03	−11.17	1,8,13
ESO 540-G032	00:50:24.32	−19:54:24.2	228	3.54±0.08	−10.46	1,8,13
ESO 407-G018	23:26:27.50	−32:23:20.0	62	2.18±0.09	−12.6	7,13

Note. — Heliocentric velocities and magnitudes are from; (1)Jerjen et al. (2000), (2)Bouchard et al. (2005), (3)de Vaucouleurs (1991), (4)Doyle et al. (2005), (5)Jerjen et al. (2000), (6)Koribalski et al. (2004), (7)Makarova et al. (2004) and (8)Bouchard et al. (2009).. Distances are from: (9)Kennicutt et al. (2008); (10)Pritzl et al. (2003); (11)Grossi et al. (2007); (12)Jacobs et al. (2009); (13)Dalcanton et al. (2009).

TABLE 2
Star Formation Properties of observed dwarf galaxies

Galaxy	SFR $10^{-5}M_{\odot}$ yr^{-1}	SFR/L(B) $10^{-13}M_{\odot}$ yr^{-1} $L_{\odot}^{-1}$	M(HI) 10^{6} $M_{\odot}$	M(HI)/L(B) $M_{\odot}/L_{\odot}$	Ref.
		Centaurus A Group			
HIPASS J1321-31	< 0.53	< 8.5	30.3	4.89	1
HIPASS J1337-39	117 ± 30	209	34.3	0.61	2
ESO 384-G16	7.3 ± 2.4	4.3	7.1	0.04	3
		Sculptor Group			
NGC 59	1520 ± 303	740	18.0	0.09	3
ESO 410-G05	< 0.13	< 1.7	0.8	0.11	4
ESO 540-G30	< 0.20	< 4.3	0.86	0.19	4
ESO 540-G32	< 0.22	< 9.2	1.02	0.43	4
ESO 407-G18	2.8 ± 0.6	16.4	16.8	0.99	5

Note. — HI Mass M(HI) are from: (1)Begum et al. (2008), (2)Doyle et al. (2005), (3)Beaulieu et al. (2006), (4)Bouchard et al. (2005), (5)Longmore et al. (1982)

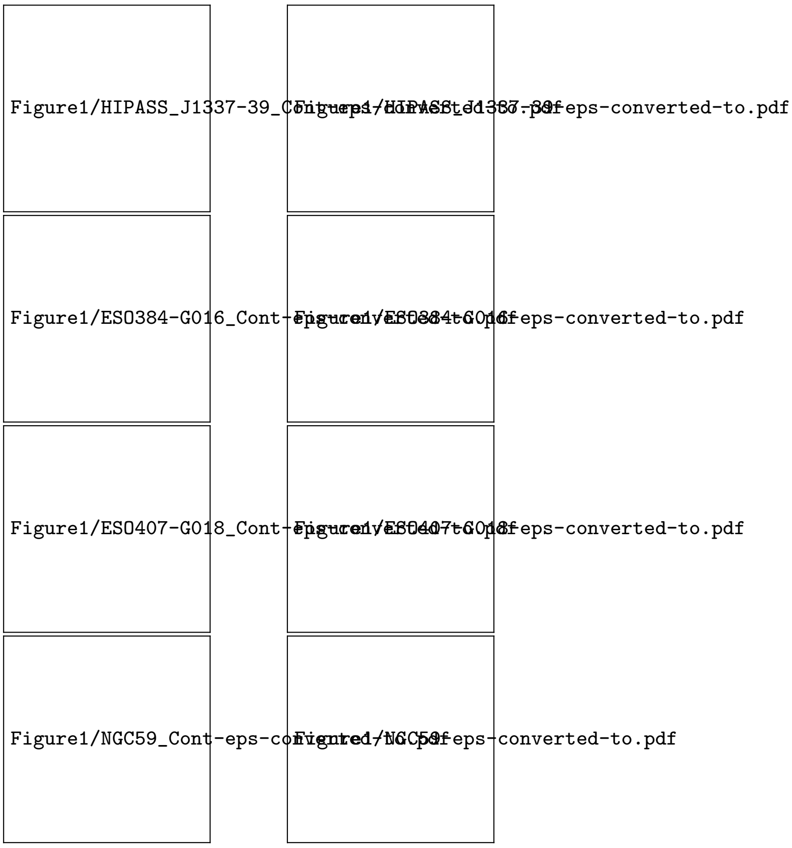

Fig. 1.— Images of four detected Centaurus A Group and Sculptor dwarf irregular galaxies. The H_α-band images of the galaxies are shown in the left panels and the continuum subtracted H_α images are shown in the right panels. The field of view is $2' \times 2'$.

FIG. 2.— test