# GROUPS of STAR-FORMING GALAXIES
# &
# DWARF in CLUSTERS
# in
# J-PAS/PLUS & S-PLUS

Jonathan D. Hernández-Fernández

March 11, 2014

**8th J-PAS MEETING**

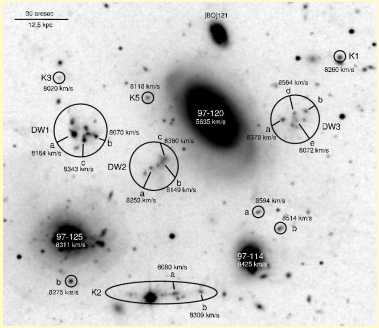
Florianpolis, Brazil

# Table of Contents

# BIG: Blue Infalling Group



H$\alpha$+continuum (~3x3 arcmin$^2$)

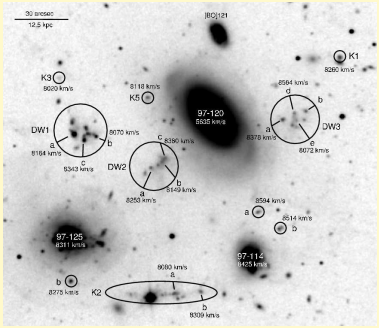



- BIG is a group at $z$=0.02 dominated by two giant ellipticals and (at least) ten of dwarfs/HII regions. This is described as *"the region with the highest density of star forming systems ever observed in the Local Universe"* (Cortese et al 2006).

# BIG: Blue Infalling Group



H$\alpha$+continuum (∼3x3 arcmin$^2$)

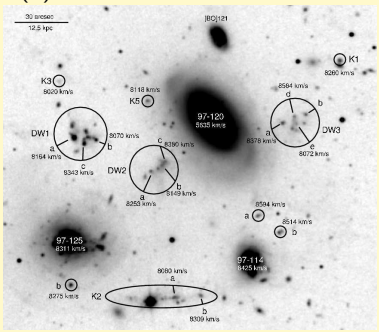



- BIG and similar examples in the Local Universe are perfect targets to study the effects of tidal interactions in star-formation activity and the gas removal mechanisms (stripping and starvation) observing the distribution of H$\alpha$ emission (Koopmann & Kenney 2004)

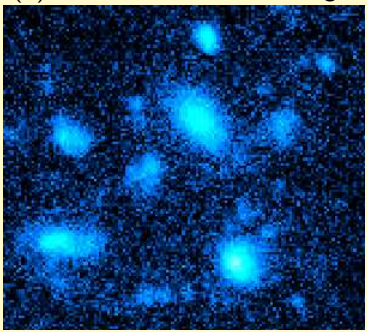
# BIG: Blue Infalling Group



(a) H$\alpha$+continuum




(b) FUV+NUV GALEX image



In a search for other examples in the Local Universe,
an observational definition of the BIG would be:

**"A group of UV bright galaxies in a compact region of the sky"**

# Search strategy



- Compilation of an all-sky sample
  of UV bright sources
  without a priori information on the object type
  or redhisft
- Search for groups in this sample

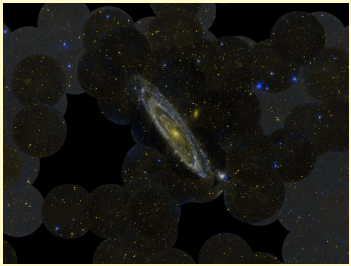
# Compilation of UV bright galaxies



- UV sources from All-sky Imaging (AIS)
  the largest sky area coveraged by GALEX in a homogeneous way
- FUV (1530 Å) selection: $17 < \mathrm{FUV} < 20.5$
  - ▷ FUV is even more biased toward star-formation than the NUV.
  - ▷ The bright UV sources in BIG are approx. in this range
    - lower limit:
      Avoiding bright galaxies wich photometry shredded in parts.
    - upper limit:
      Reliable sources, avoiding oversize the sample of FUV sources.
- We avoid the Milky Way disk:
  galactic latitude modulus $|b| > 15$ deg.
- UV color selection: $-1.50 < (\mathrm{FUV-NUV})_{dered} < 2.75$
  Avoiding blue artifacts, red stars, etc.
- $uv\_artifact <= 1 \sim$ good quality detections

# Self-crossmatching

- South Sky ($\delta$<+10 deg): **577729 AIS sources**
- North Sky ($\delta$>-10 deg): **508382 AIS sources**



There is field overlapping: the same source could be observed by neighboring GALEX fields. $\rightarrow$ Cross-matching of output GALEX sample with itself to avoid duplicate sources (see Bianchi et al. 2014 for the lastest update in this issue)

- South Sky $\rightarrow$ 524342 unique sources ($\sim$9 % dup. sources)
- North Sky $\rightarrow$ 454877 unique sources ($\sim$10 % dup. sources)

# Search of groups: FoFA



- **Fried-of-Friend Algorithm** applied to sky positions (Blanton 2001) grouping elements with a sky separation equal or less than the **linking-length**

  **linking-length** $= \Delta\theta = 1.5$ arcmin
  (originally selected to be observed with **BTFi** $\sim 3\times3$ arcmin$^2$)
  $\sim$88 kpc at $z$=0.05

- $4 \leq n_{\rm UV} < 7$ (avoiding the center of star clusters)

- We crossmatch with NED (NASA/IPAC Extragalactic Database) to retrieve the object type and redshift for the galaxy sample.

# Results

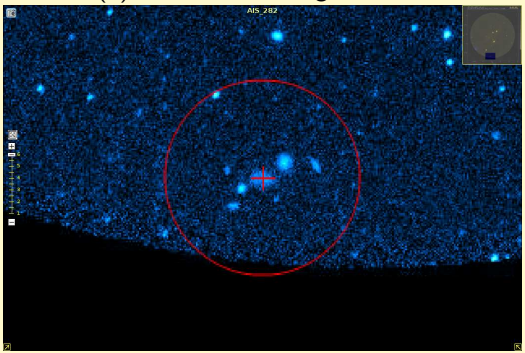


Just three examples from
a sample of hundreds of galaxy groups ...

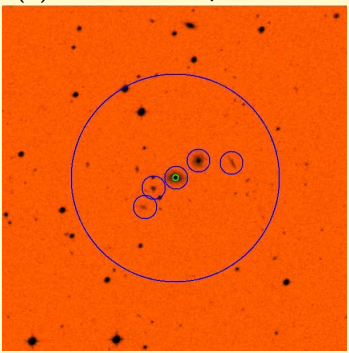
# Group ♯1



(a) FUV+NUV image




(b) visible countepart

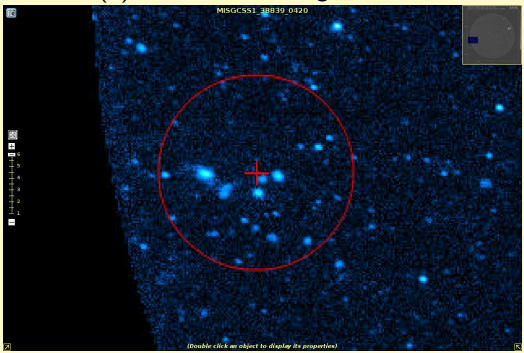


∘ brigth FUV member; ∘ spectroscopic counterpart

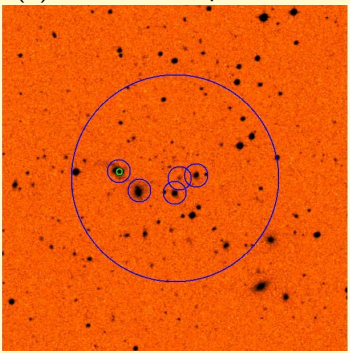
(RA, Dec): (43.7911, -21.5939) deg.
∘ $z$=0.027396 : $v_{los}$=8213 km $s^{-1}$

# Group ♯2

(a) FUV+NUV image




(b) visible countepart



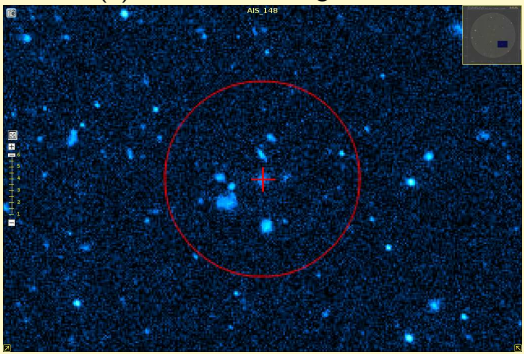
○ brigth FUV member; ○ spectroscopic counterpart

(RA, Dec): (66.7313, -49.1177) deg.
○ $z$=0.058280 : $v_{los}$=17472 km s$^{-1}$
∗ There is an Abell cluster: ABELL S0457 at 0.5 arcmin
w/o spectroscopic counterpart

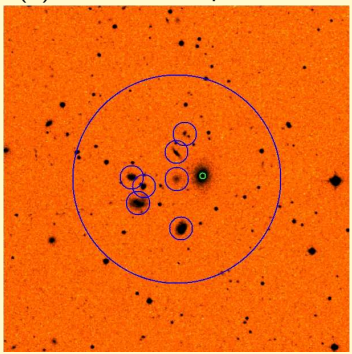
# Group ♯9



(a) FUV+NUV image




(b) visible countepart



○ brigth FUV member; ○ spectroscopic counterpart

(RA, Dec): (349.180, 9.81615) deg.
○ $z$=0.039417 : $v_{los}$=11817 km s$^{-1}$?
○ GALEX source with FUV=21.60, NUV=20.33
Pegasus III "Cluster" at 4.832 arcmin
w/o redshift counterpart

# Results

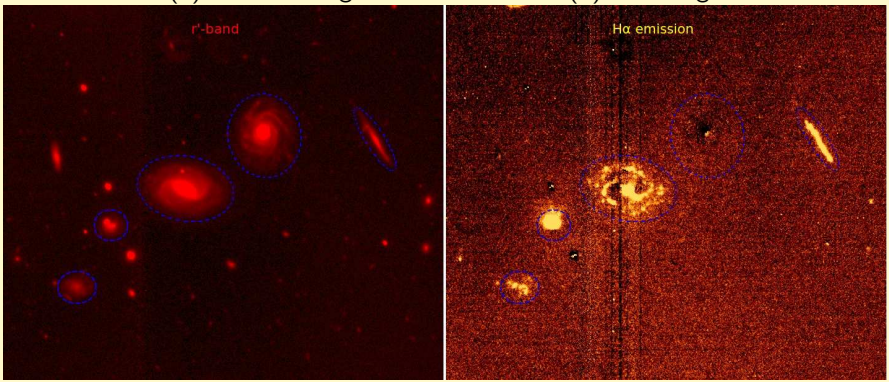


- $(n_{gal} \geq 3) = 273$ groups (3 galaxies!)
  with three or more UV sources
  previously identified as "galaxy" in NED
- $(n_z \geq 1) = 206$ groups (1 redhisft!)
  with at least one known galaxy redshift
- $(m_z \geq 3) = 42$ groups (physical triplets!)
  with at least three galaxies
  inside a velocity range of 1200 km $s^{-1}$

# Group ♯1

Narrow-band SOAR observations (2nd February)

(a) r'-band image (b) H$\alpha$ image




▷ "anemic spiral" or it is outside the (velocity range of the) group ...

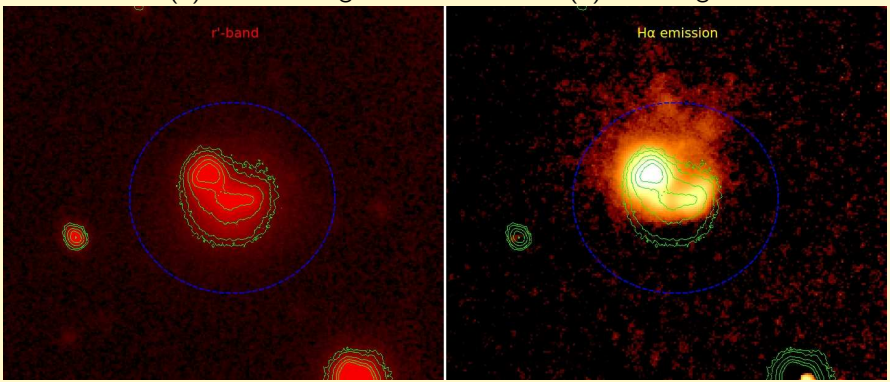
▷ dwarf with a displaced H$\alpha$ emission

# Stripped dwarf galaxy



Narrow band SOAR observations (2nd February)

(a) r'-band image (b) H$\alpha$ image




- PGC 826130: $M_B$=−17.77
- Maybe two objects?

# Summary



- All-sky search in GALEX of groups of star-forming galaxies in the Local Universe.
- A sample of compact groups of star-forming galaxies ideal to study the H$\alpha$ emission distribution.
- Future work:
  - H$\alpha$ and spectroscopy observations (SOAR, CAHA, Chile, etc)

# J-PAS/PLUS and S-PLUS proposals



There is no option to do a search
in rest-frame FUV or NUV:

observed $u'$-band corresponds to
rest-frame NUV at z$\sim$0.5

$\rightarrow$ diff. in $\mu$ between $z\sim$0.05 and $z\sim$0.5 is
$\mu\approx$6 mag.

$\Rightarrow u' \sim$ [ 23, 26.5 ]

# J-PAS/PLUS and J-PLUS proposals

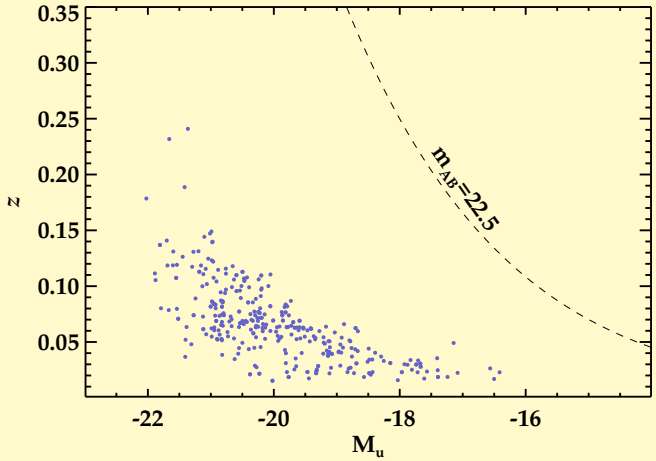


We propose a search for CGSFGs in the u'-band
-the bluest broad-band in J-PAS-
for a lower redhisft range

What is the **distribution in u'-band absolute magnitude**
for the galaxy sample in star-forming groups?

# J-PAS/PLUS and S-PLUS proposals

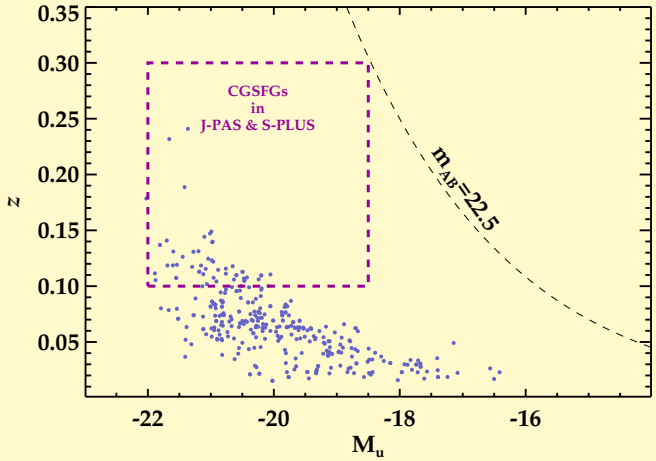





- Extension of the sample of star-forming groups
-

# J-PAS/PLUS and S-PLUS proposals

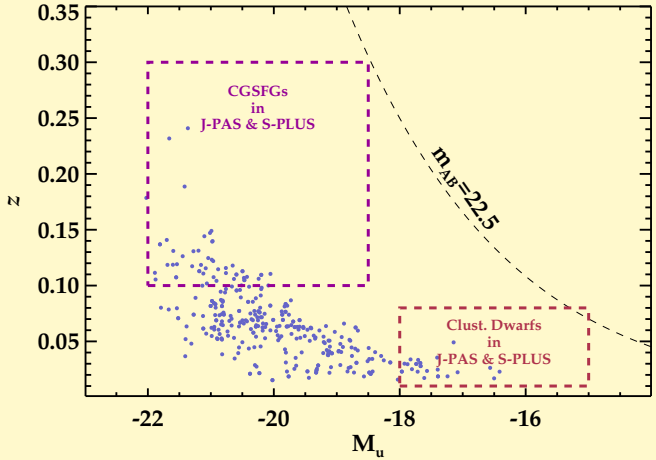





- Extension of the sample of star-forming groups up ot $z \sim 0.3$
-

# J-PAS/PLUS and S-PLUS proposals



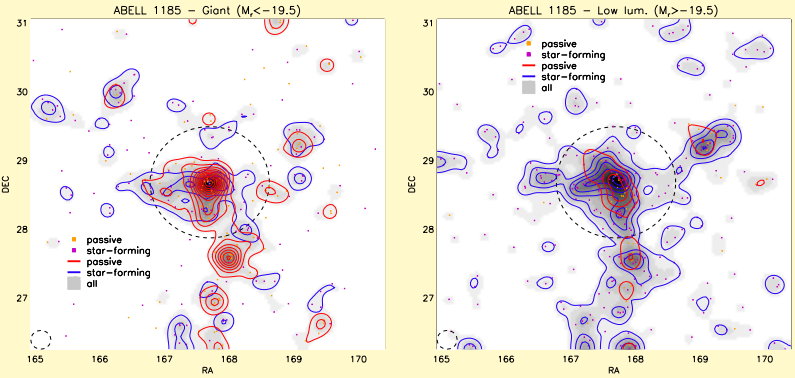



- Extension of sample of star-forming groups up ot $z \sim 0.3$
- Dwarf -18$<M_{abs}<$-15 cluster galaxy population up to $z \sim 0.08$

# Spatial distribution in clusters



(a) High-luminosity $M_r < -19.5$ (b) Low-luminosity $-19.5 < M_r < -18$




(Hernandez-Fernandez et al. 2012, also Haines et al. 2006)

- High-luminoisiy passive and star-forming galaxies are in all environments
- Low-luminosity star-formings in a more extended distribution and only few passive galaixes outside substructures.

# Summary



- All-sky search in GALEX of groups of star-forming galaxies in the Local Universe.
- A sample of compact groups of star-forming galaxies ideal to study the H$\alpha$ emission distribution.
- Future work: H$\alpha$ and spectroscopy observations (SOAR, CAHA, Chile, etc)
- Extension of sample of star-forming groups up ot $z \sim$0.3
- Dwarf -18$<M_{abs}<$-15 cluster galaxy population up to $z\sim$0.08

# BACKUPS

# Results



- ($n_{\rm UV}$=4, North) = 210 groups
- ($n_{\rm UV}$=4, South) = 656 groups
- ($n_{\rm UV}$=5, North) = 42 groups
- ($n_{\rm UV}$=5, South) = 290 groups
- ($n_{\rm UV}$=6, North) = 16 groups
- ($n_{\rm UV}$=6, South) = 177 groups
- ($n_{\rm UV}$=7, North) = 6 groups
- ($n_{\rm UV}$=7, South) = 113 groups