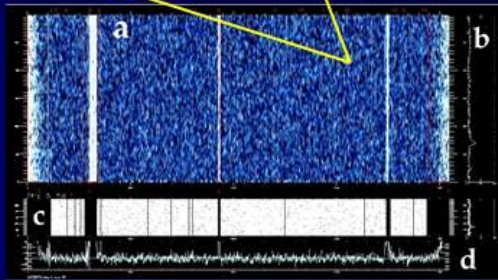# ALFALFA status Jan 2013

Thanks for your distinctive contributions to ALFALFA!

Happy 50th, Jeff!

From Martha, Riccardo and the Cornell EGGs

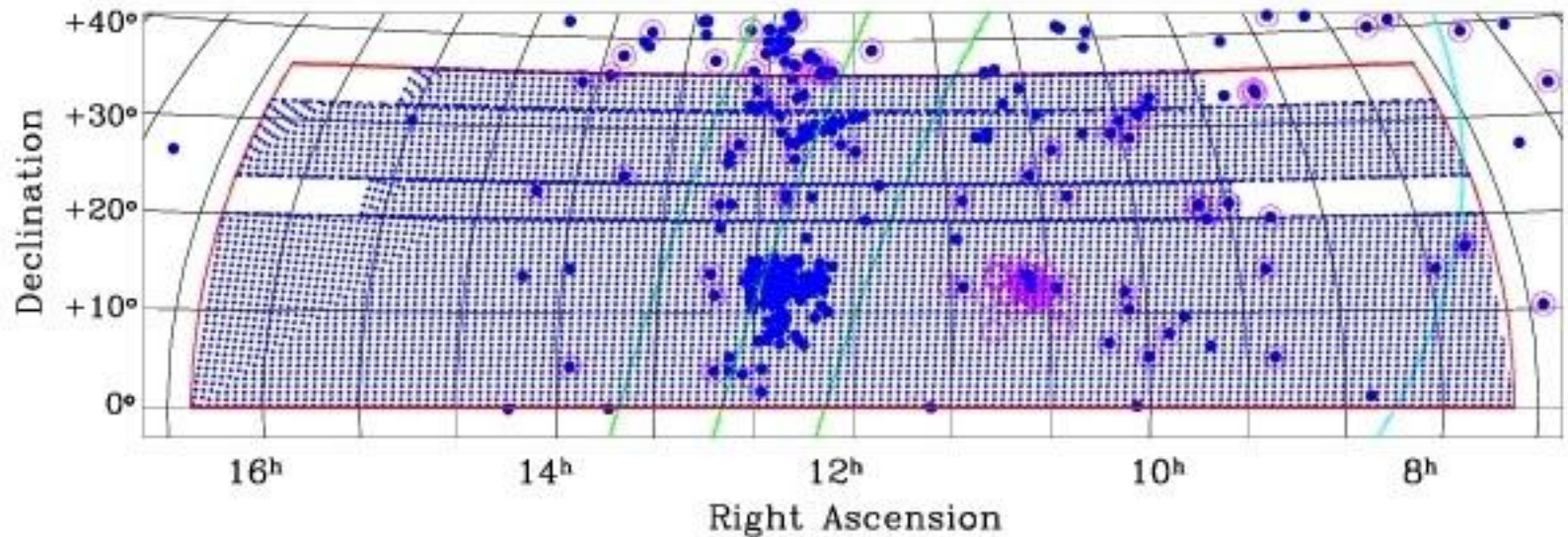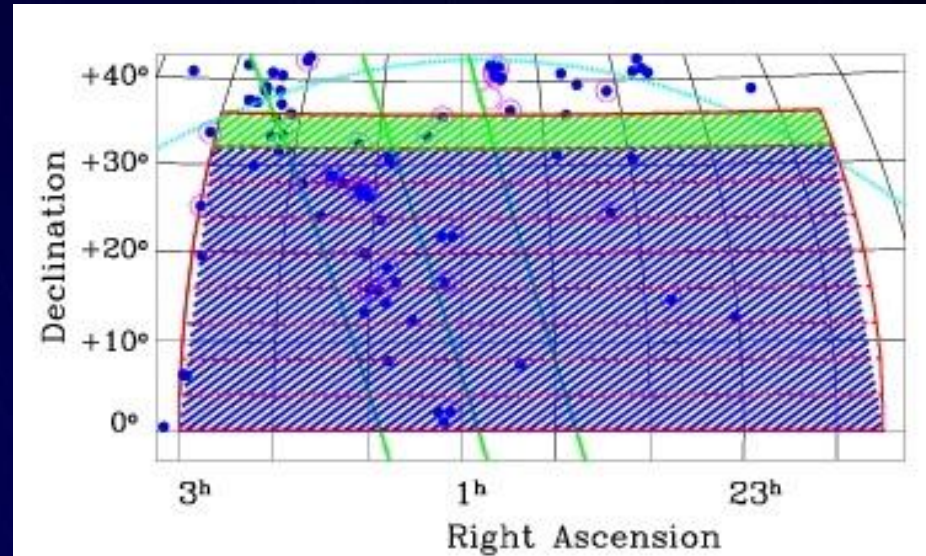Martha Haynes
Cornell University
UAT13
Jan 2013

ALFALFA observing status Jan 2013

It's done!

ALFALFA catalog & results

ALFALFA 40%: α40 catalog published!
- Included in data products:
  - SDSS cross match PhotoID/SpecObjID/flag
  - Extended comments
  - Revised website (issues with hardware compatability)
- New HI line flux density scale; validated

ALFALFA 58% in progress
- + spring strips from 0 < Dec < +4 , +16 to + 20, +28 < Dec < 30
- Adding DR7 and DR8 (including α40 in DR8)

Soon: fall 01, 07, 09, 23
Next: all ALFALFA a-grids only (in support of SHIELD/minihalo)

ALFALFA science:
- 41+ papers in refereed literature + 7+ submitted
- 7 PhDs completed + 10 in progress
- The awesome Undergraduate ALFALFA Team: 19 colleges and universities, 145 students & 21 faculty participants in first 4 years
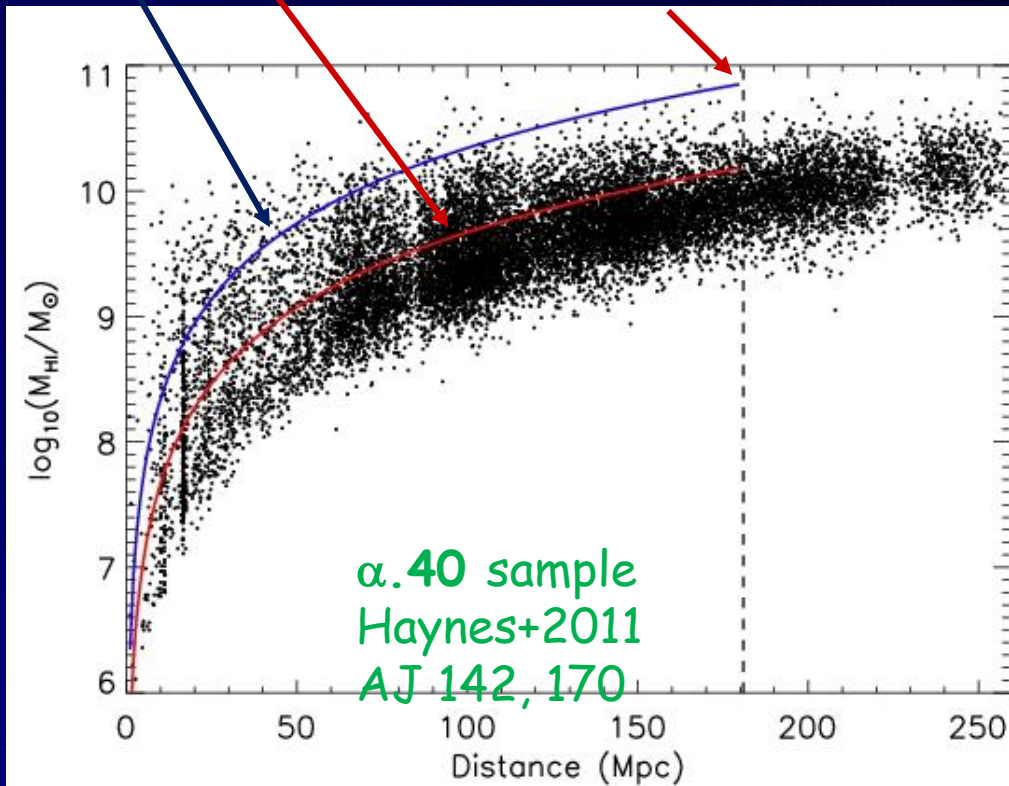
ALFALFA: A robust census

- 29X times higher source density than HIPASS
- HIPASS missed the "most luminous" HI galaxies because of its volume limitations (not the usual case with surveys…)

HIPASS completeness limit
HIPASS detection limit
HIPASS bandwidth

α.**40** sample
Haynes+2011
AJ 142, 170

- ALFALFA covers adequate **volume** with adequate **sensitivity**
  - 15000+ detections in **40%** of final area
  - 70% are "new" !!!

- In addition to sensitivity, bandwidth and velocity resolution, ALFALFA yields positions to < 20"
  ⇒ Identification of most probable **optical counterpart** (OC)

- Continuum/RFI tracked
  ⇒ Allows **stacking** at arbitrary positions

ALFALFA dwarfs

AGC122212

AGC212824

AGC200512

AGC220856

AGC213796

AGC223913

AGC174514

UGC7889
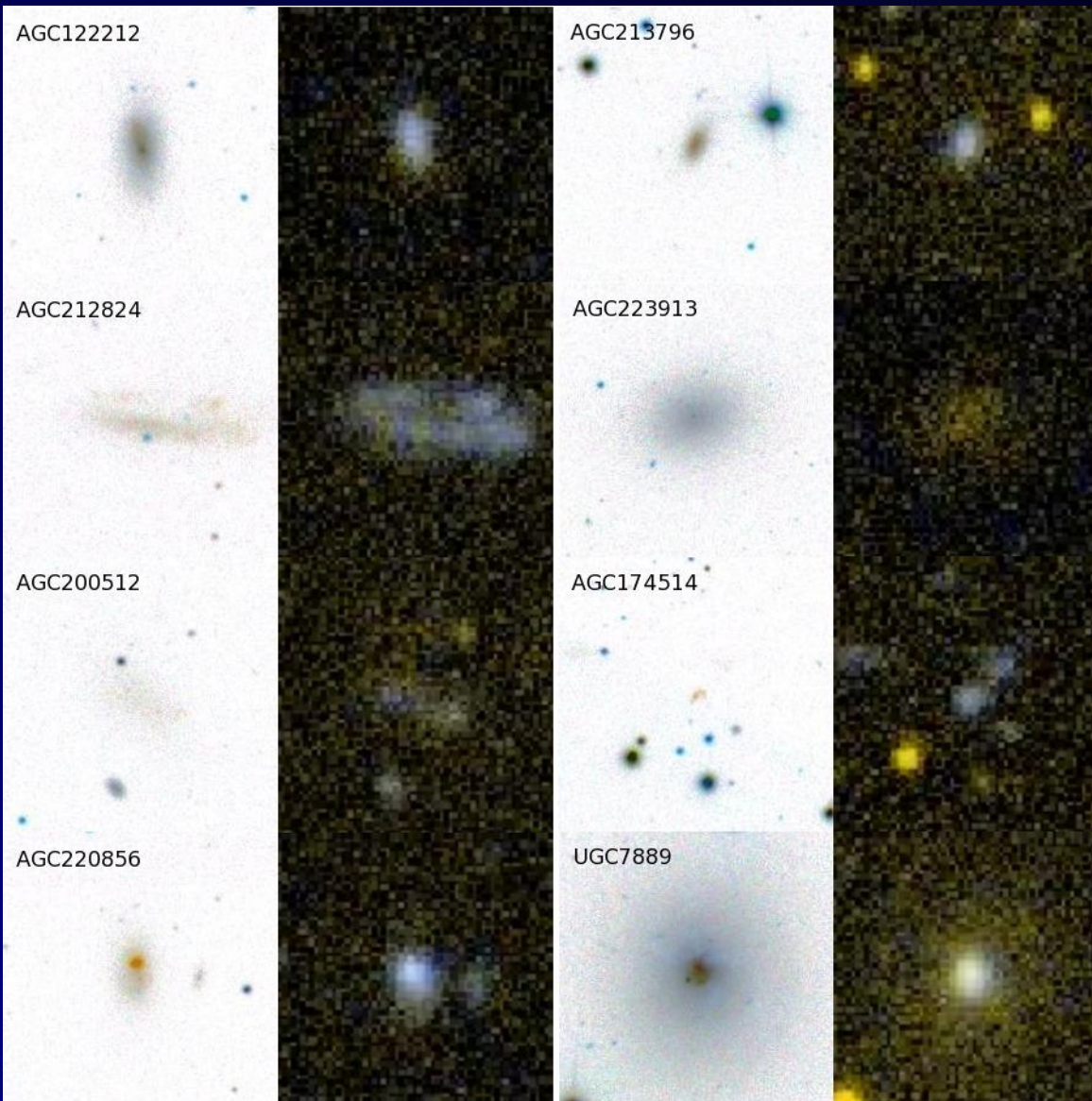
Complete sample with
log $M_H/M_\odot$ < 7.7
and
W_{50} < 80 km/s

SED-fitting to
FUV/NUV/ugriz

Huang et al. 2012a
Astro.J. 143, 133

Virgo dE's
Hallenbeck+ 2012
Astro.J. 144, 87

ALFALFA

ALFALFA cosmology

Robust census of HI over *cosmologically significant*

- The HI Mass Function: analogous to a luminosity function (Martin+2010 ApJ 723, 1359)

- The HI correlation function: HI galaxies the least-clustered population (Martin+ 2012 ApJ 750, 38)

- The HI velocity width function: a perspective on the halo mass function. Maps onto SDSS VF but low mass halos still missing. (Papastergis+ 2011 ApJ 739, 38)

- Gas-rich galaxies reside in high spin parameter halos (Huang+ 2012 ApJ 756, 113)
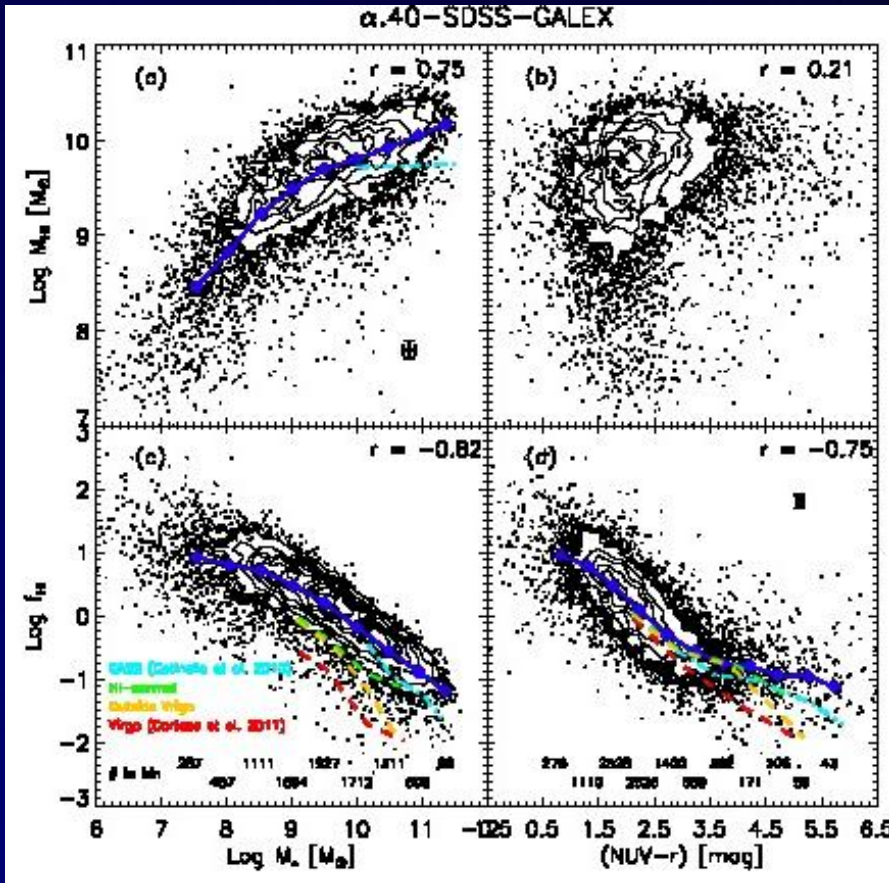

$\phi^* = 0.0048$
$\log(M_*) = 9.96$
$\alpha = -1.33$
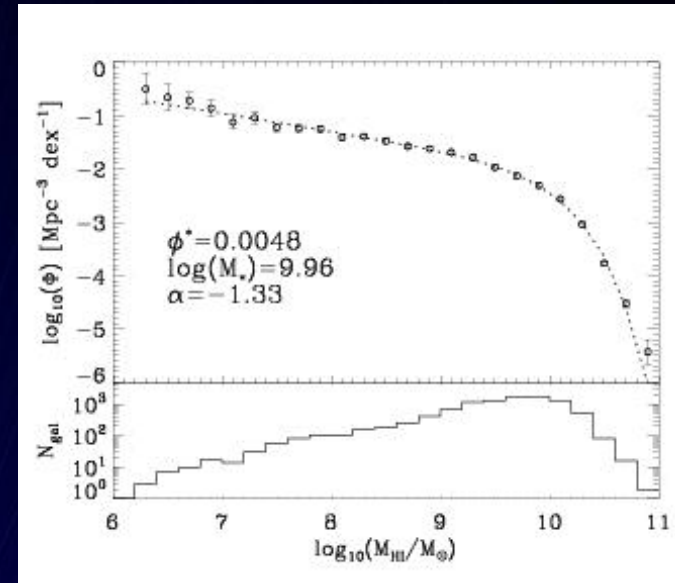
More high HI mass galaxies than previously thought: Good news for SKA!

The ALFALFA population

α.40-SDSS-GALEX

Shan Huang (Cornell) PhD thesis
Huang+ (2012a) AJ 143, 133
Huang+ (2012b) ApJ 756, 113

- Although extinction is lower in HI selected galaxies, it is not negligible.

- HI selected galaxies are gas-rich, bluer, and have higher SFR and SSFRs but lower SFEs and metallicities than optically selected ones. Their gas depletion times (Roberts' times) are longer.
  - Consistent with HI population having more extended disks.

- Nearly all star forming galaxies have HI.
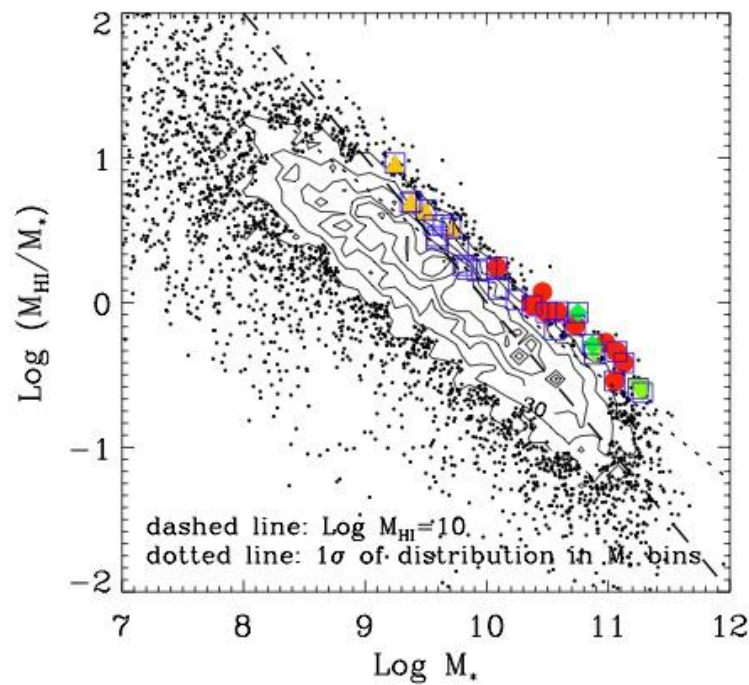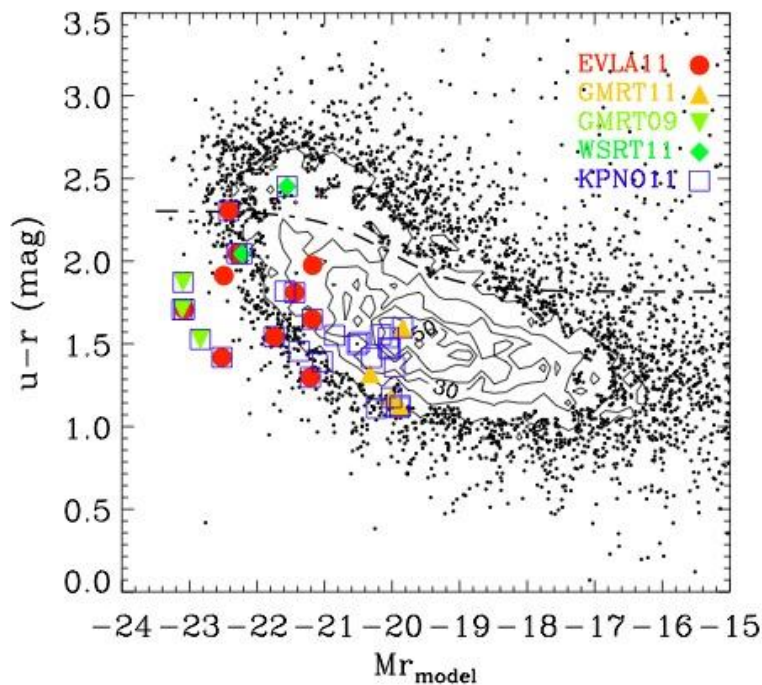 - There are low f_{gas} dwarfs

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HIghMass: HI-rich massive galaxies

Some of the high HI mass galaxies are exceptionally gas-rich; in some, the HI makes up the dominant form of baryons. How/why?

For the SKA, we need to understand the HI population itself

- M_* calculated from SDSS/SED fitting
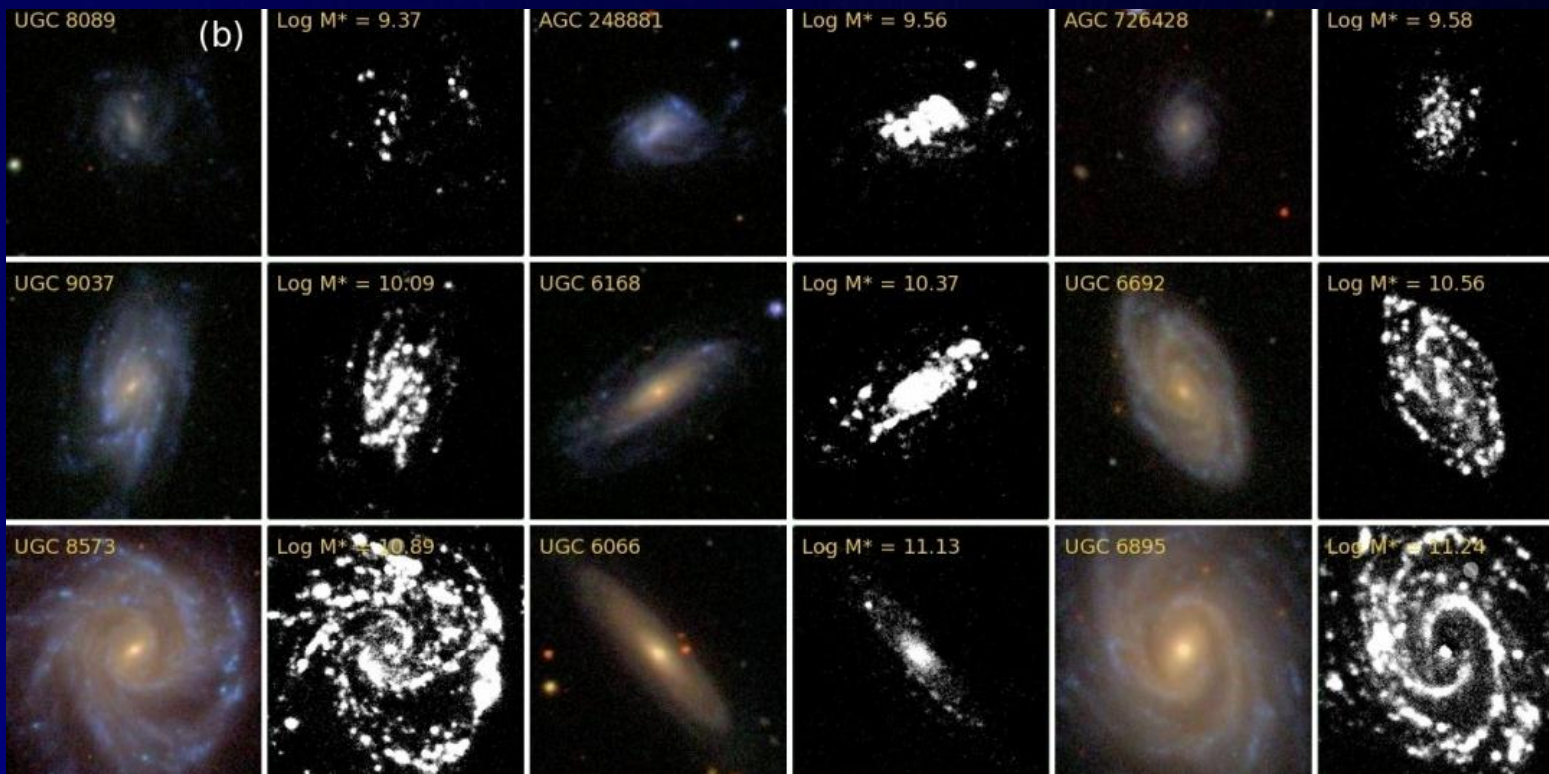- Account for internal extinction!

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HIghMass:
High HI mass, gas-rich galaxies at z~0

- Candidates to migrate from BC to RS but not yet reached phase of significant SF?

- Alternative mode of (late) accretion?

Too much gas? Or Too few stars?
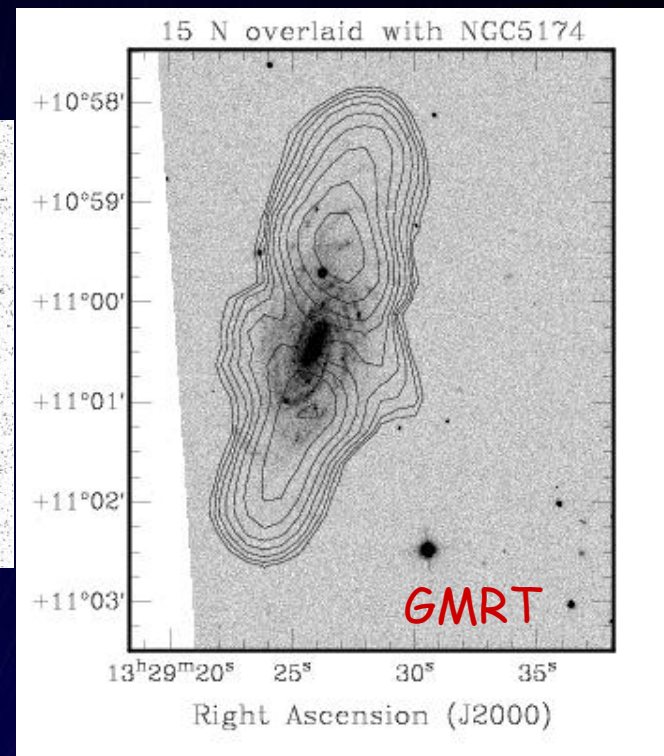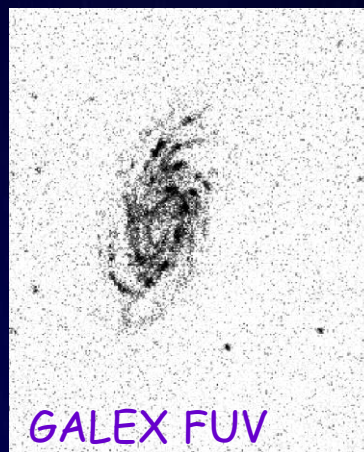
Huang+ 2012c, in prep

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HIghMass:
High HI mass, gas-rich galaxies at z~0

ALFALFA detects a rich population with log M_{HI} > 10.

- SFR seems to be appropriate for their stellar and molecular masses

- Too much HI gas!

- => higher than average spin parameter?

GALEX FUV

15 N overlaid with NGC5174

GMRT

Right Ascension (J2000)

Preliminary; Chengalur+

Huang (PhD: GALEX, Herschel, Hα, SED-fitting)
Adams (PhD: GMRT/WSRT)
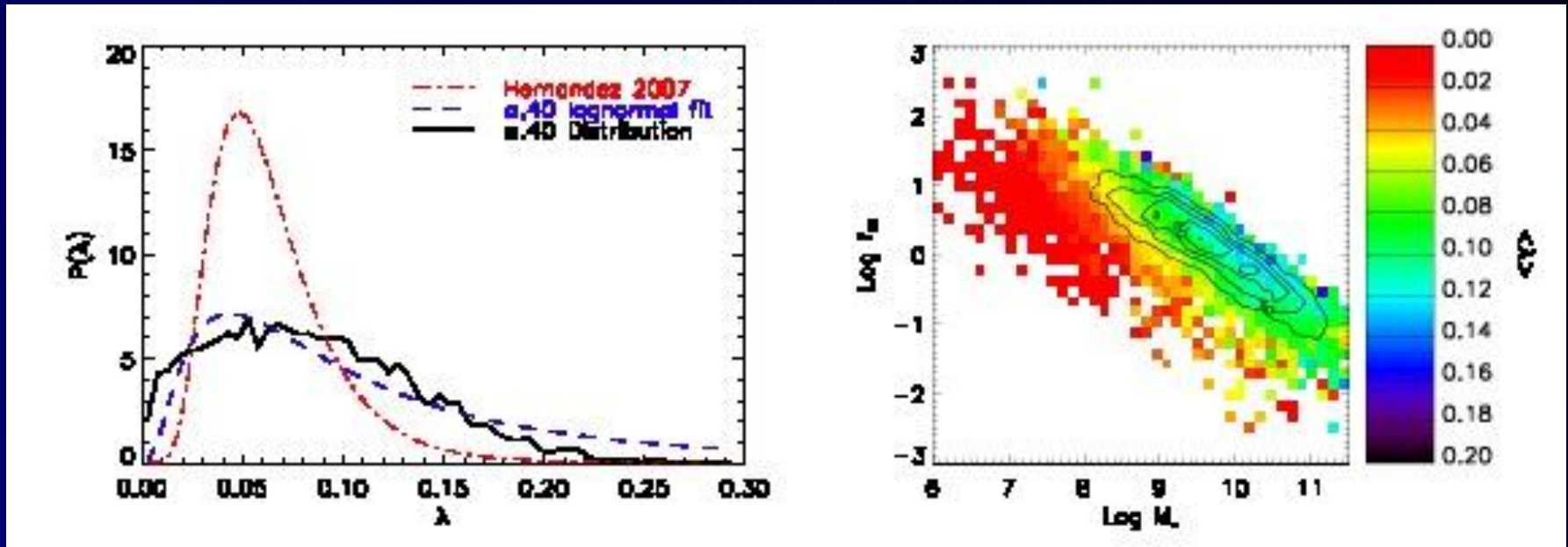Hallenbeck (PhD: EVLA, CARMA)
Papastergis (PhD: IRAM 30m)

ALFALFA

What is the ALFALFA population?

The spin parameter: $$\lambda = J|E|^{1/2}G^{-1}M^{-5/2}$$

ALFALFA population is characterized by high spin parameter.

Shan Huang+ (2012b) ApJ 756, 113

ALFALFA: Volume + Sensitivity

- ALFALFA is the first blind HI survey to sample a cosmologically significant volume at z=0
  - Robust determination of HIMF and VF at z=0
  - HI-selected galaxies are weakly clustered on small scales but trace the large scale structure
  - Work on environmental variations continues as ALFALFA grows

- There are **no** "dark" HI galaxies with HI masses $\geq$ ~$10^9 M_\odot$

- ALFALFA sources provide the means to determine the baryon fraction as fn. of halo mass and test models of dropoff at M_{halo} ~ $10^9 M$

- ALFALFA identifies a set of gas-rich Local Group "minihalo" candidates; evidence which will refute or confirm that hypothesis is being sought. And, in Leo P: (maybe) we have found one!

- ALFALFA detects a previously-unrecognized population of very high HI mass galaxies with HI masses > $10^{10} M_\odot$; in some, cool gas contributes the dominant form of baryons. => Good news for SKA!

  - There is more ALFALFA to be harvested!

Big issues for discussion
(these are interrelated)

- We could use more help with flagging
  - Thanks this year especially to Lyle (my HERO!)

- We could use more help with the grid/source extraction/cataloging (always…)

- We need to look carefully at the LBW data.

- New proposal (March 1st) for further followup observations?

- How can we move the collaborative groups project along?