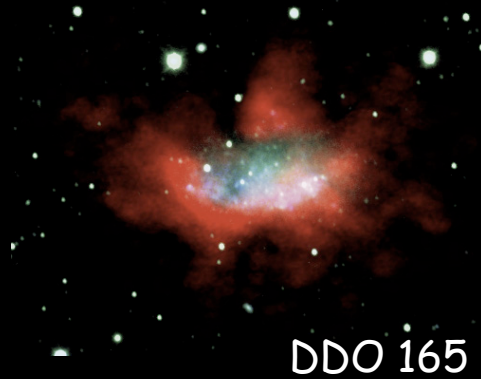


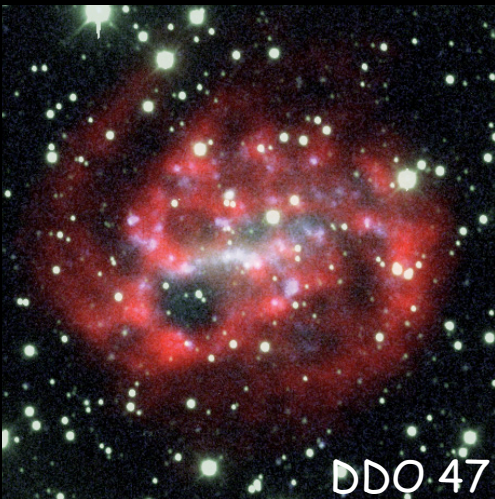
DDO 133



DDO 165



Stellar Surface Brightness Profiles of Dwarf Galaxies



DDO 47

Kim Herrmann

Lowell Observatory

Star Formation in Dwarf Galaxies

June 20, 2012

NGC 1569



(Images: LT team and Lauren Hill)

A Riddle

Look at a galaxy! Its disk light

Falls exponentially- is that right?

If you look deeply, often you'll see

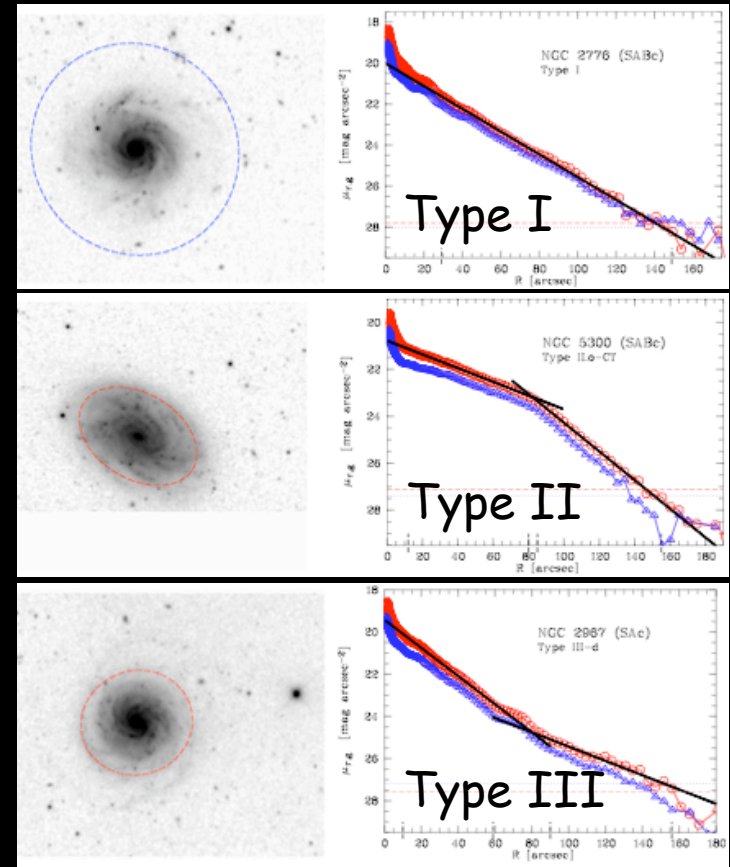
Signs of us- in both Types II and III!

Why do we exist? Explore the gas,

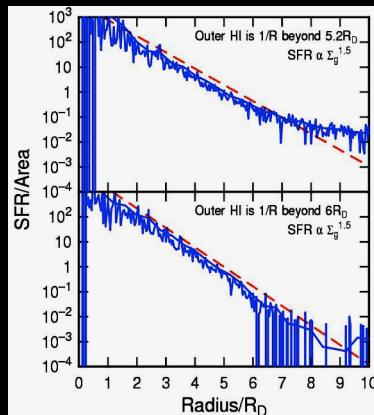
Motions near and far. Profile the mass.

Search with care; do whatever it takes.

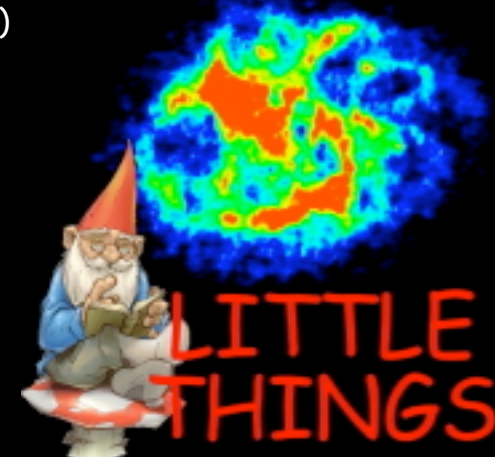
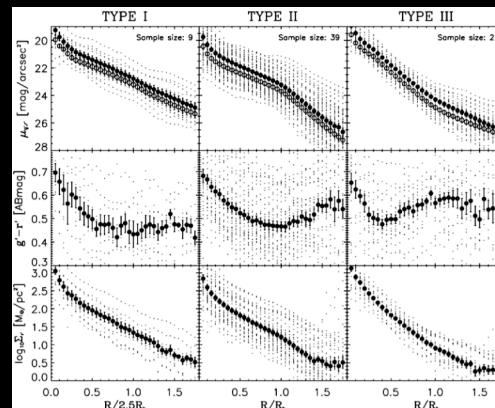
We are Surface Brightness Profile Breaks!

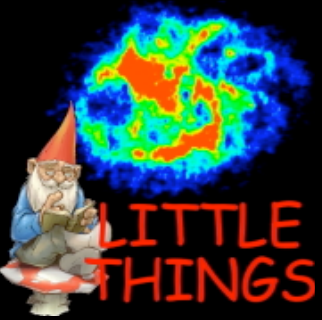


(Bakos et al. 2008)



(Elmegreen & Hunter, 2006)

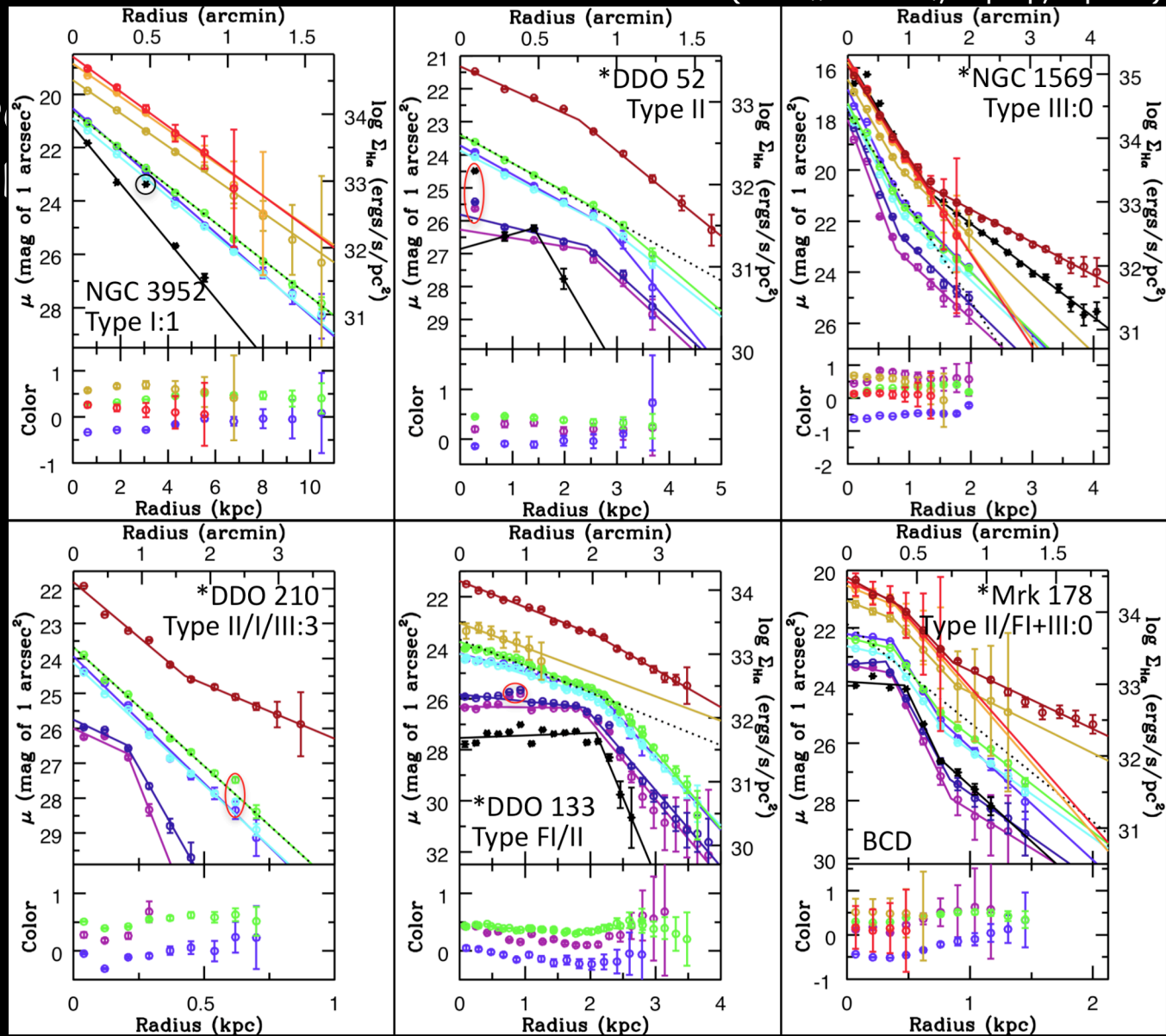
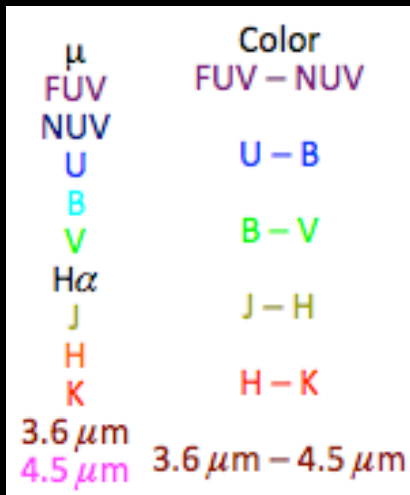




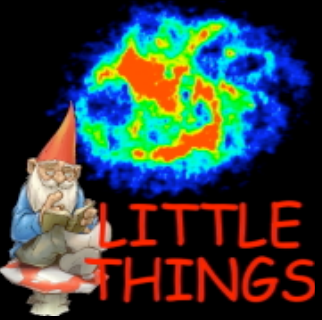
The Sample and Fitting

(Herrmann et al., in prep, Paper I)

- 141 Dwarfs (partially)
 - 96 dIms, 26 BC
- ≤ 11 passbands
- 776 profiles!



(Hunter & Elmegreen 2004, 2006;
 Hunter et al. 2006, 2010, 2011,
 Zhang et al. 2012
 + Spitzer Legacy projects)



How common are the Types?

(Herrmann et al., in prep, Paper I)

G+11 = Gutiérrez et al. 2011

- 47 early-type unbarred spirals
- R-band only

E+08 = Erwin et al. 2008

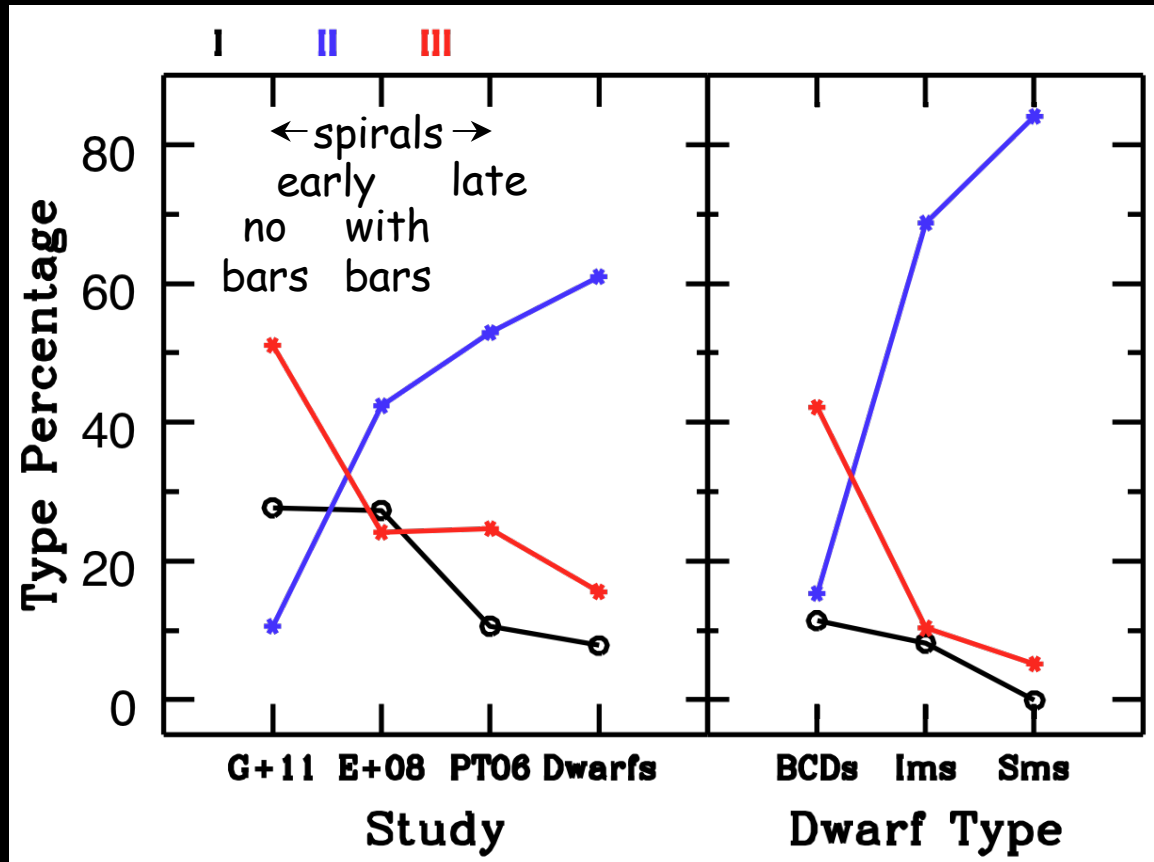
- 66 early-type barred spirals
- R-band only

PT06 = Pohlen & Trujillo 2006

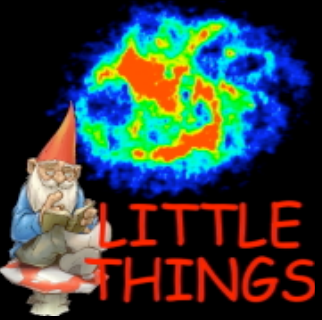
- 85 late-type spirals
- g' & r'

Dwarfs = current study

- 141 dwarf galaxies



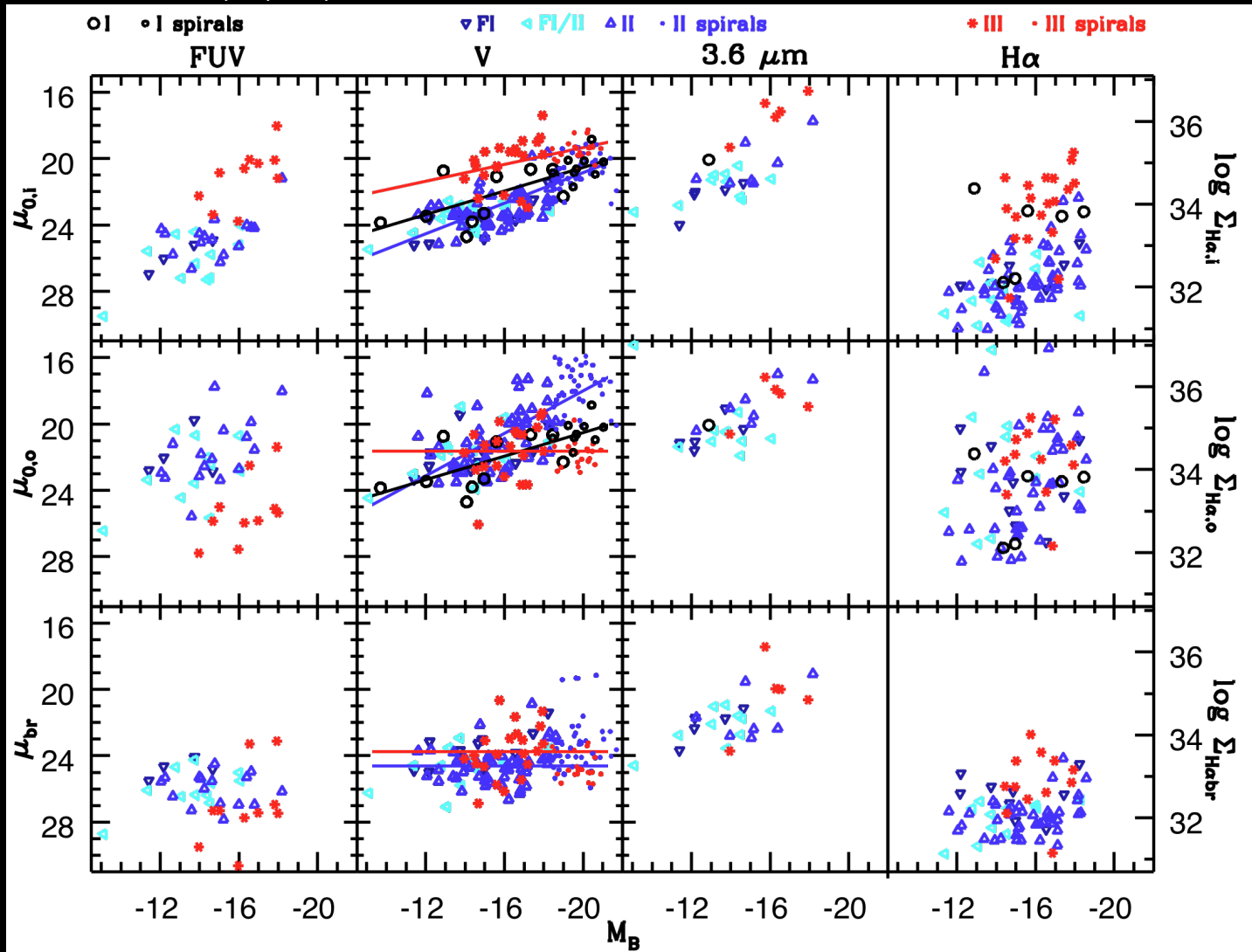
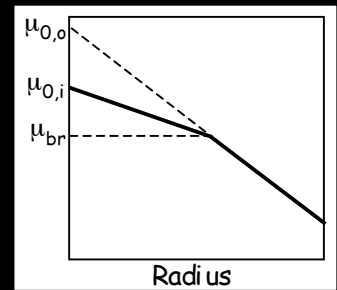
- Clear trends with Hubble Types
- Sms and BCDs: predominantly II & III, respectively



Are there trends?

$\mu_{0,i}$, $\mu_{0,o}$, & μ_{br}

(Herrmann et al., in prep, Paper I)

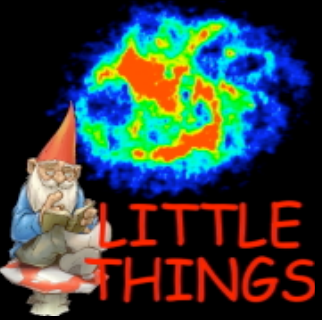


Central Surface
Brightness, $\mu_{0,i}$
(inner fit)

Outer Surface
Brightness
Projected
to Center, $\mu_{0,o}$

Surface
Brightness
at Break, μ_{br}

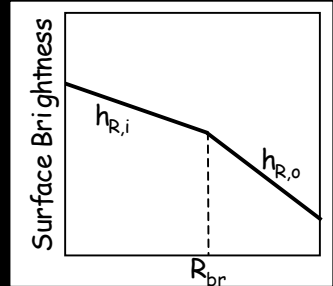
(spiral data
from PT06)



Are there trends?

$$h_{R,i}, h_{R,o}, R_{br}$$

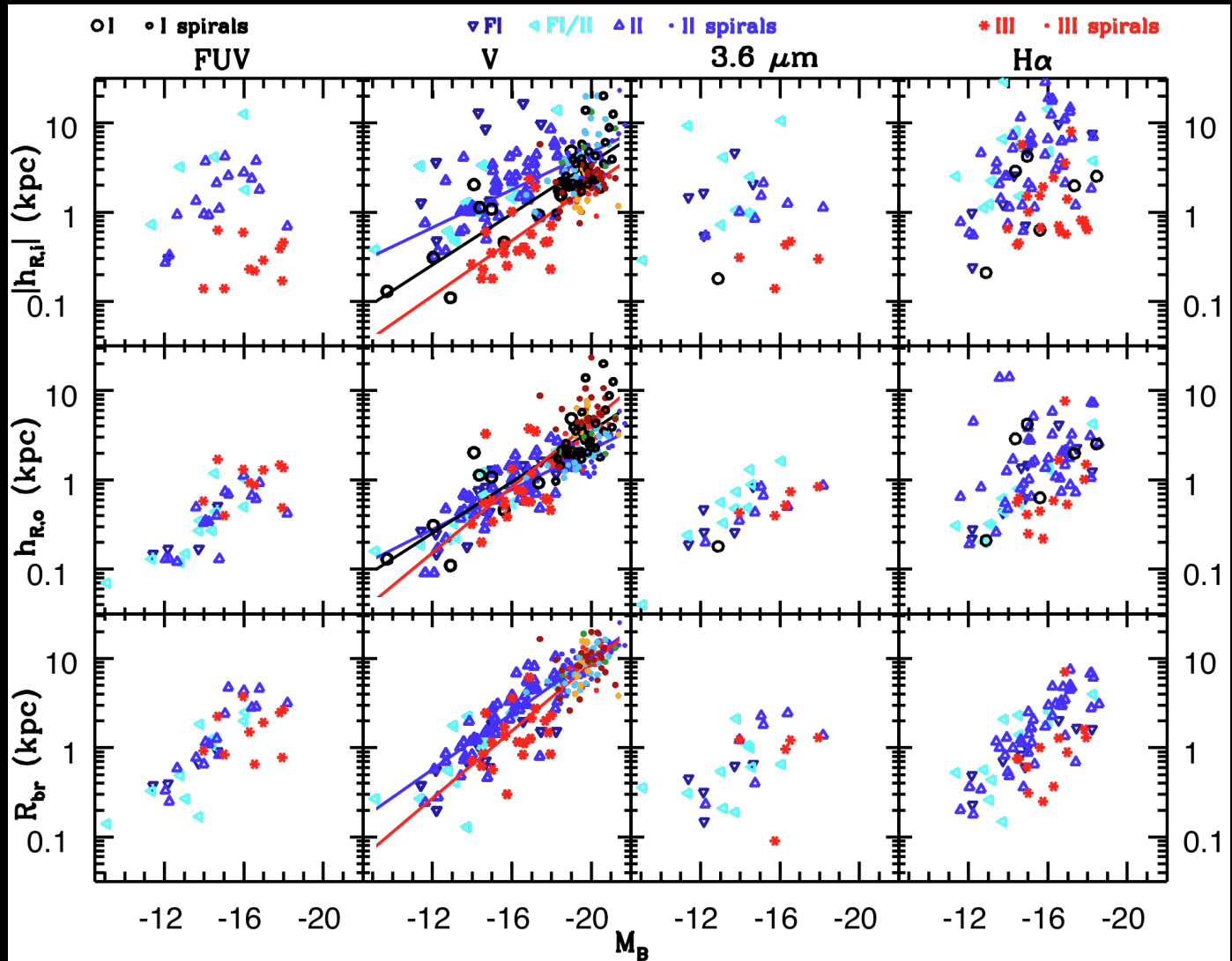
(Herrmann et al., in prep, Paper I)

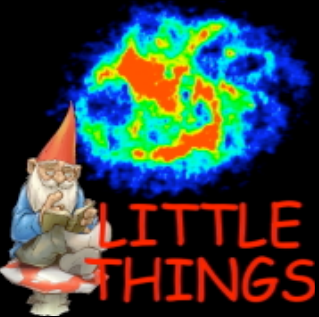


|Inner scale length|
 $h_{R,i}$ (kpc)

Outer scale length
 $h_{R,o}$ (kpc)

Break location
 R_{br} (kpc)

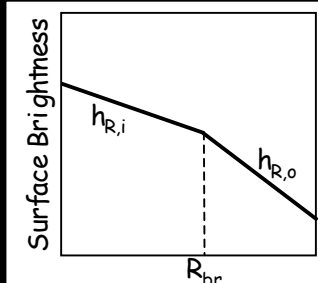




Are there trends?

$h_{R,i}$, $h_{R,o}$, R_{br} vs. λ

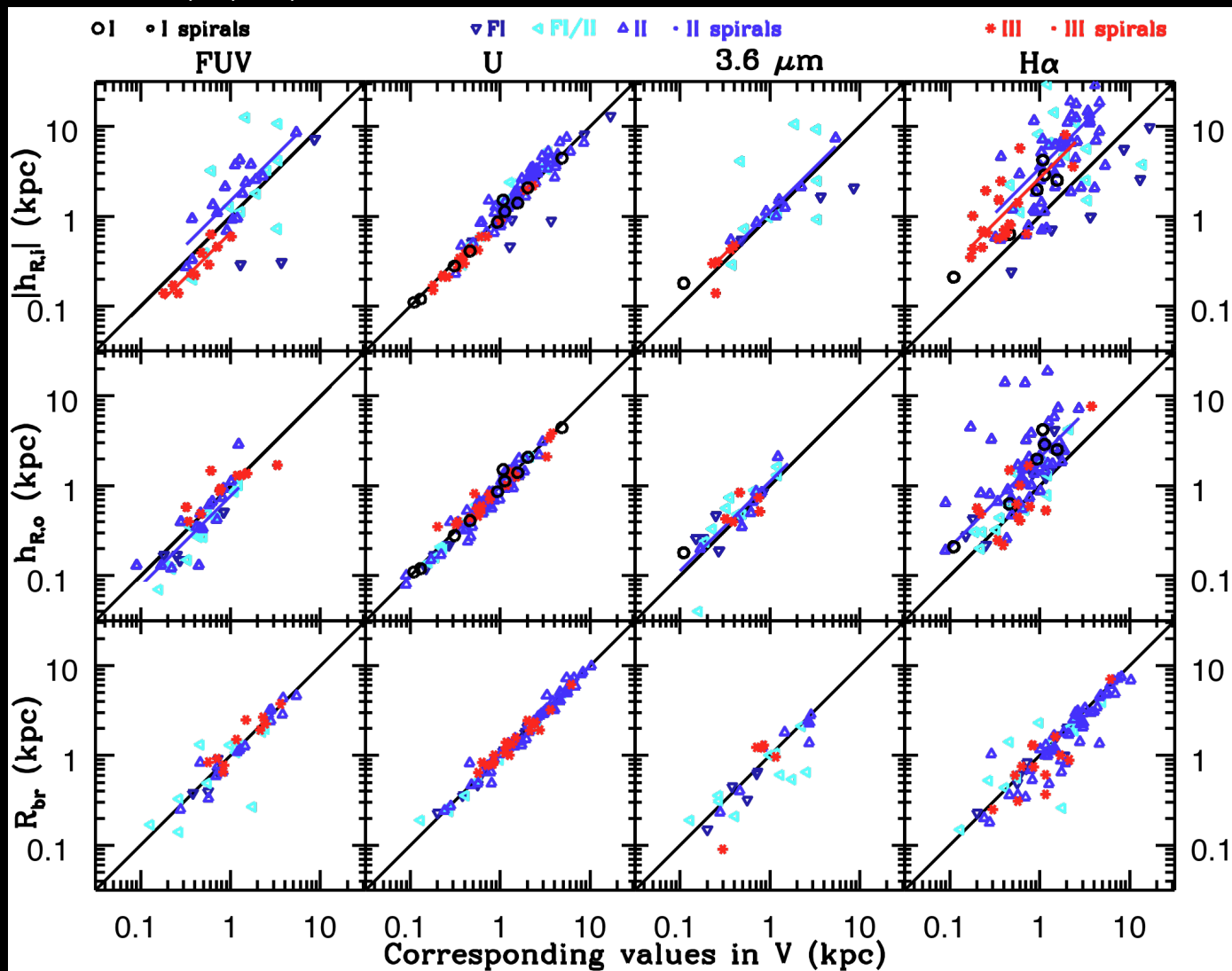
(Herrmann et al., in prep, Paper I)

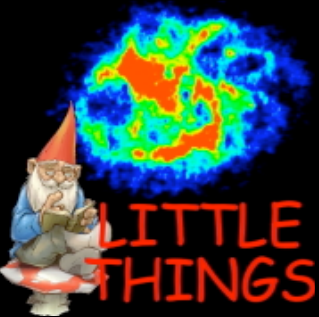


Inner scale length
 $h_{R,i}$ (kpc)

Outer scale length
 $h_{R,o}$ (kpc)

Break location
 R_{br} (kpc)

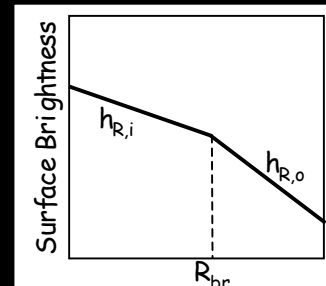




Are there trends?

$h_{R,i}$, $h_{R,o}$, R_{br} vs. λ

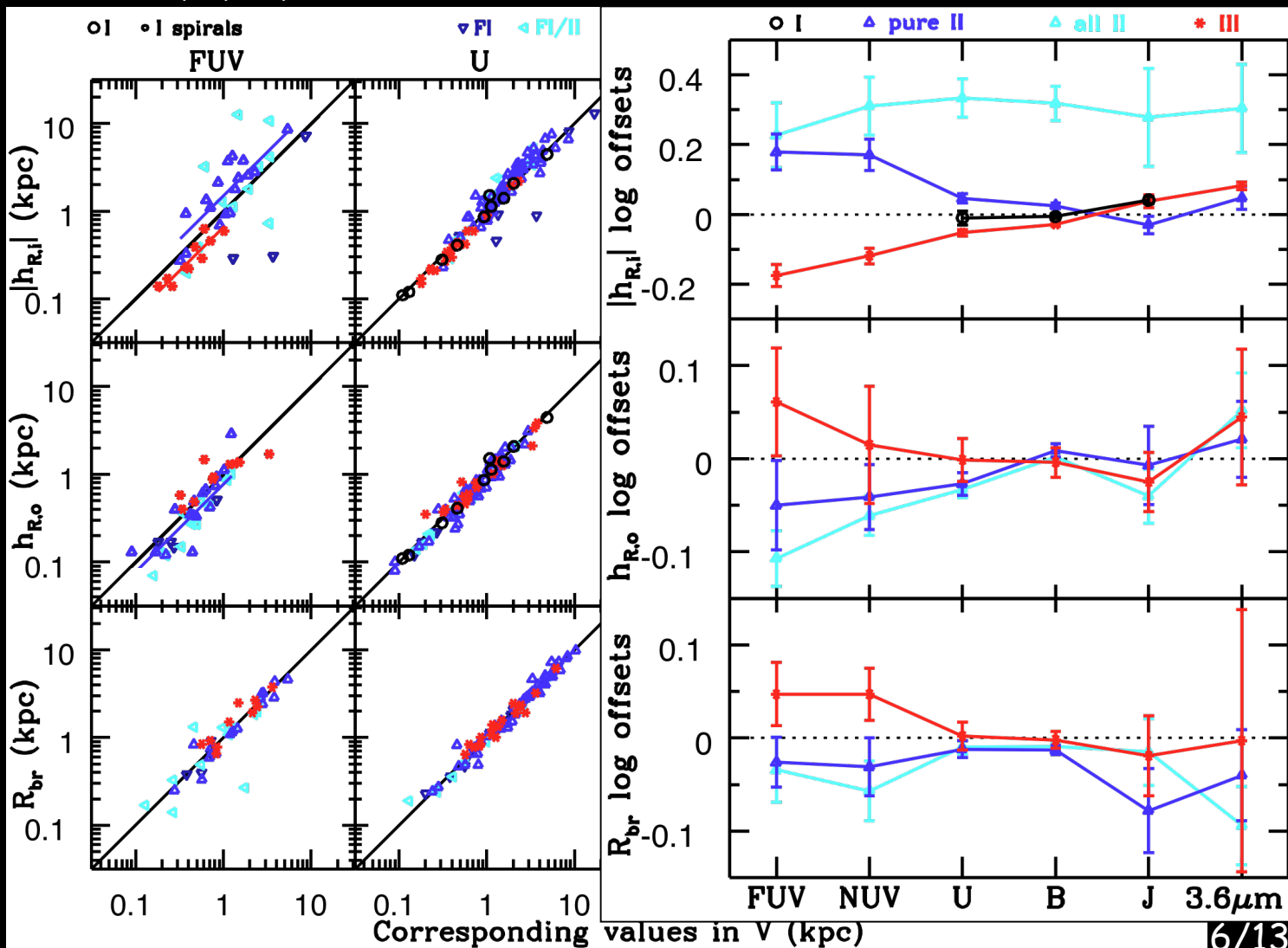
(Herrmann et al., in prep, Paper I)

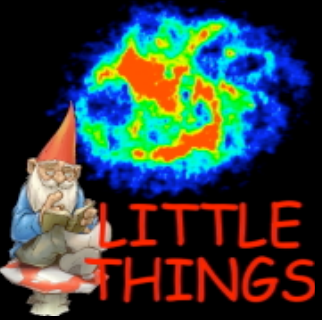


Inner scale length
 $h_{R,i}$ (kpc)

Outer scale length
 $h_{R,o}$ (kpc)

Break location
 R_{br} (kpc)

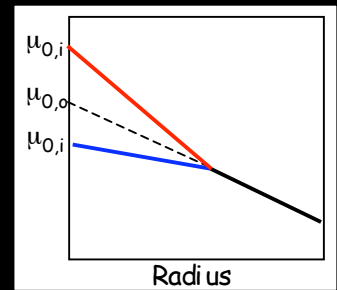




Are there trends?

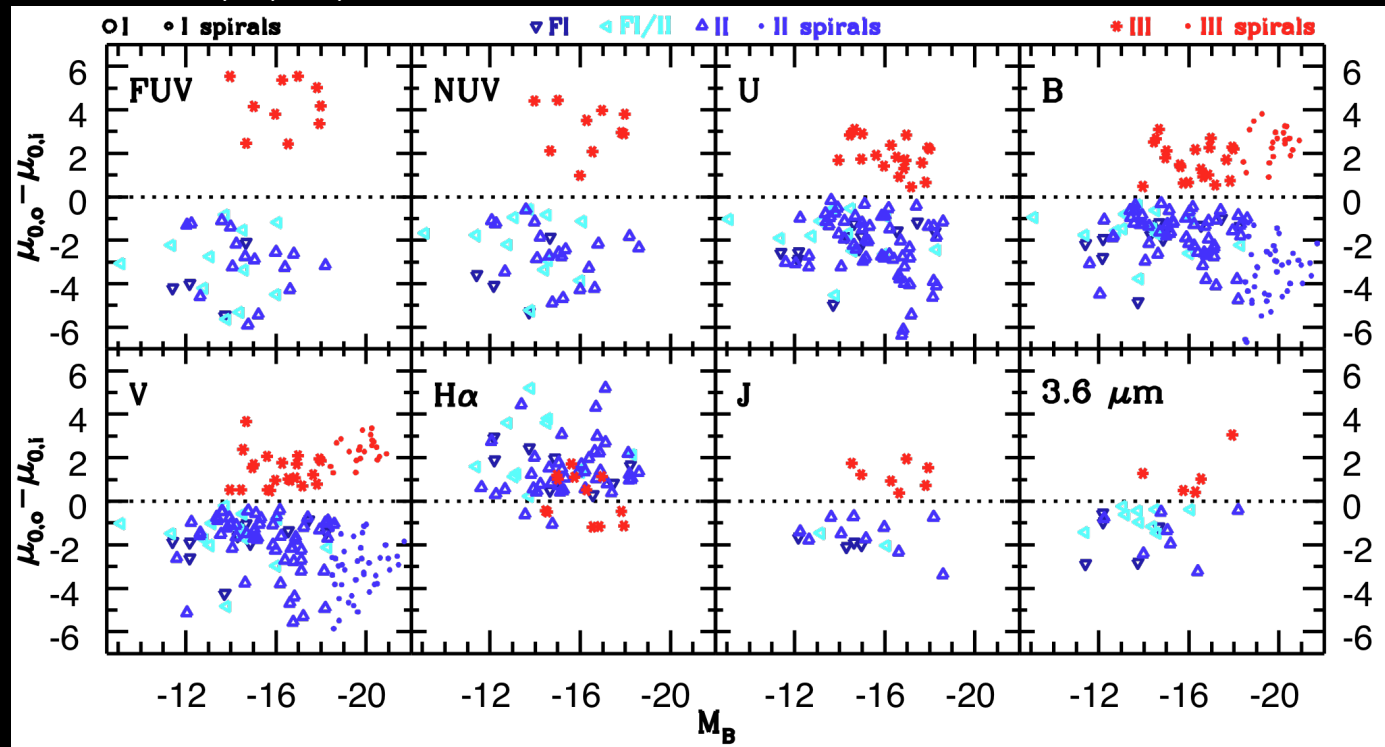
$\mu_{0,0} - \mu_{0,i}$: Break Strength

(Herrmann et al., in prep, Paper I)



Outer Surface
Brightness
Projected
to Center, $\mu_{0,0}$

Central Surface
Brightness, $\mu_{0,i}$

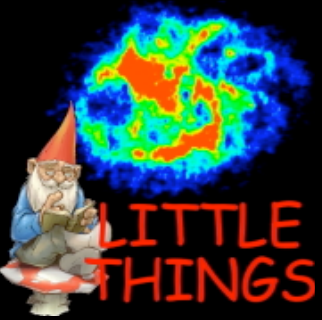


Break is stronger in bluer bands (i.e., FUV)

Break is stronger in spirals than in dwarfs

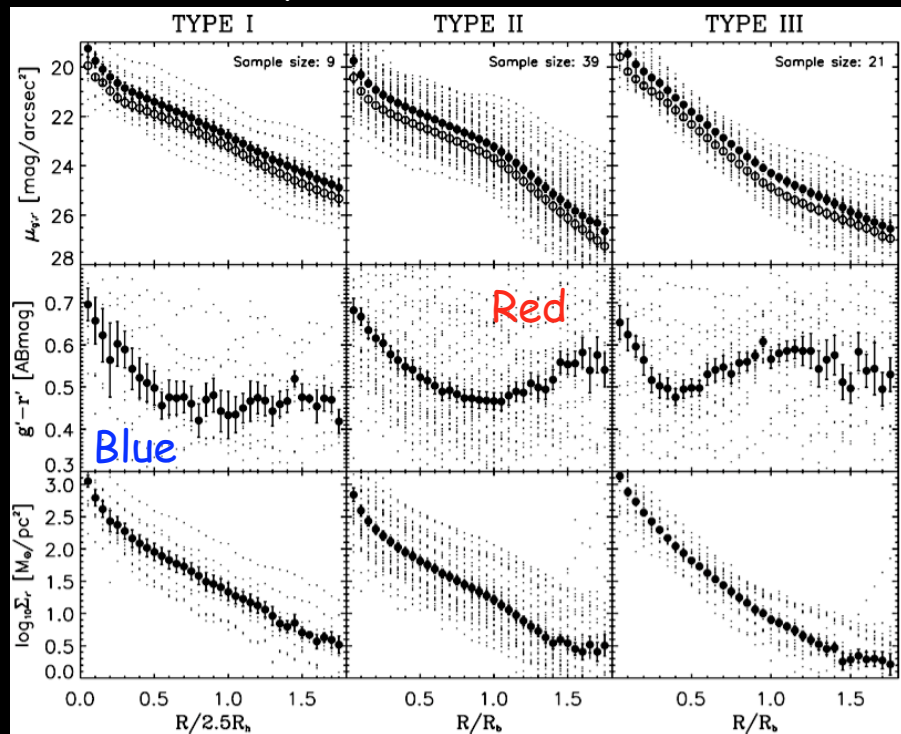
We can also look at radial colors...

(spiral data
from PT06)

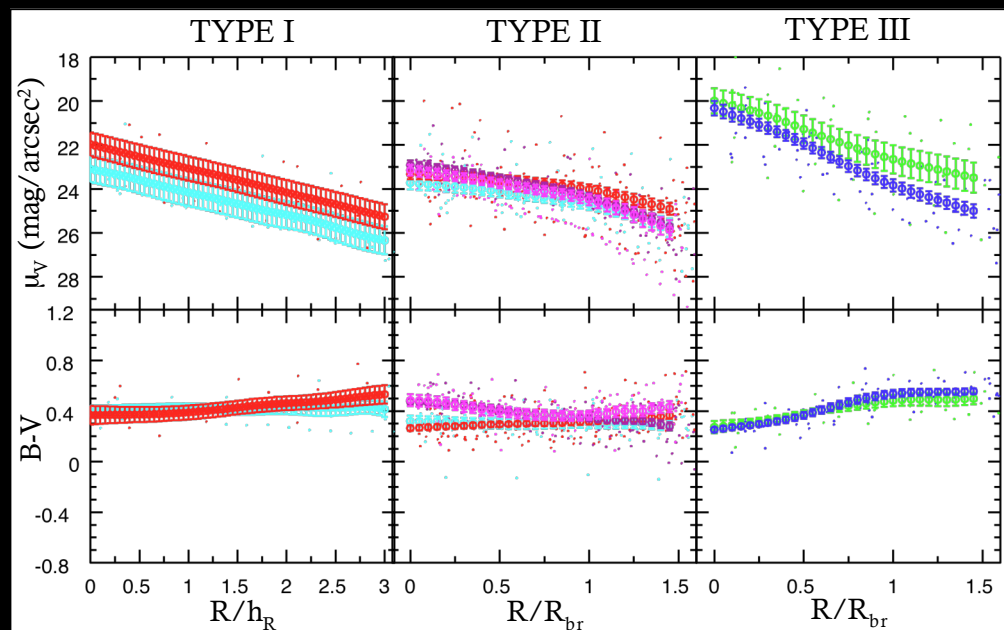


Radial Color Trends in B-V

In Spirals (Bakos et al. 2008)



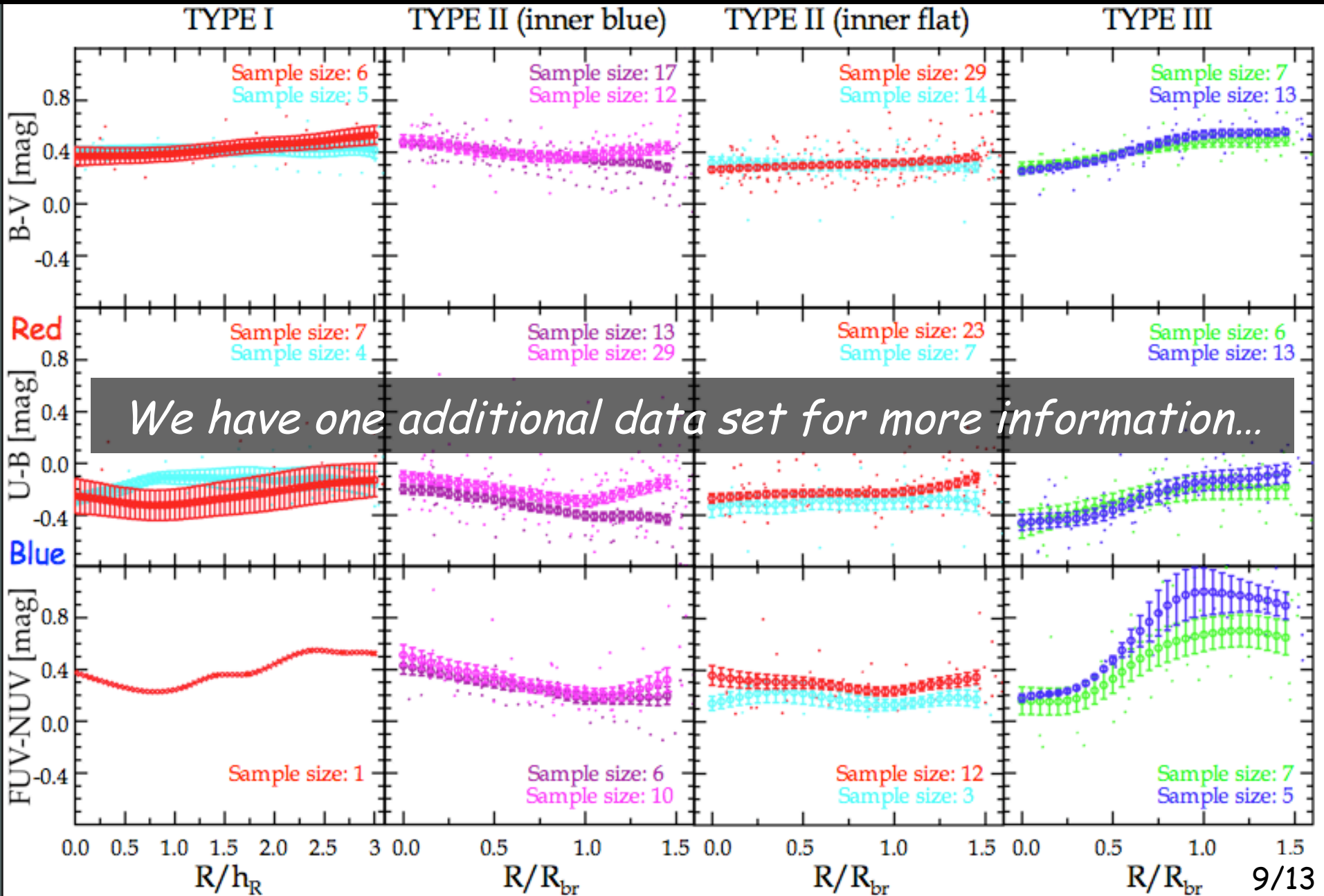
In Dwarfs (Herrmann et al., in prep, Paper II)

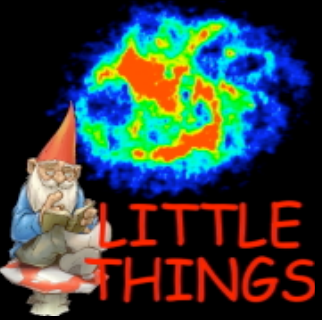


There are some outliers
What about different colors?

Same general trends, but not always the same trend for B-V, U-B, & FUV-NUV

(Herrmann et al., in prep, Paper II)



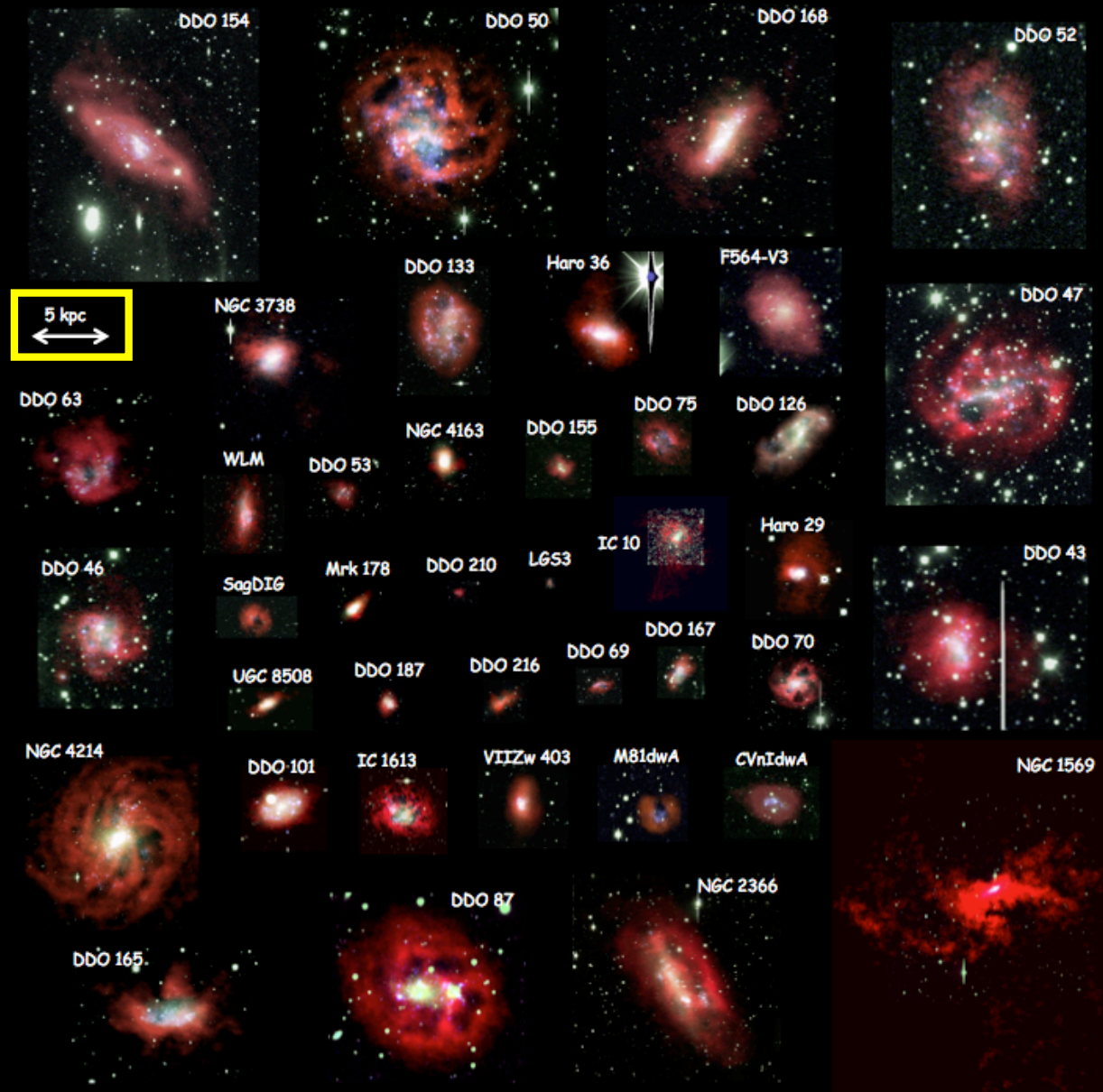


LITTLE THINGS Subsample:

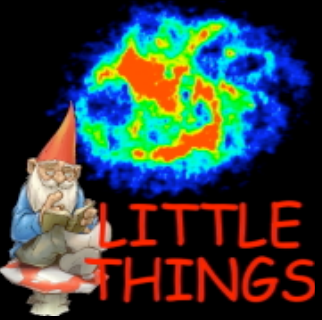
36 dIms + 4 BCDs

Local
Irregulars
That
Trace
Luminosity
Extremes

The
H (hydrogen)
I (neutral)
Nearby
Galaxy
Survey



HI
(red)
FUV
(blue)
V
(green)



Breaks & LT HI kinematics

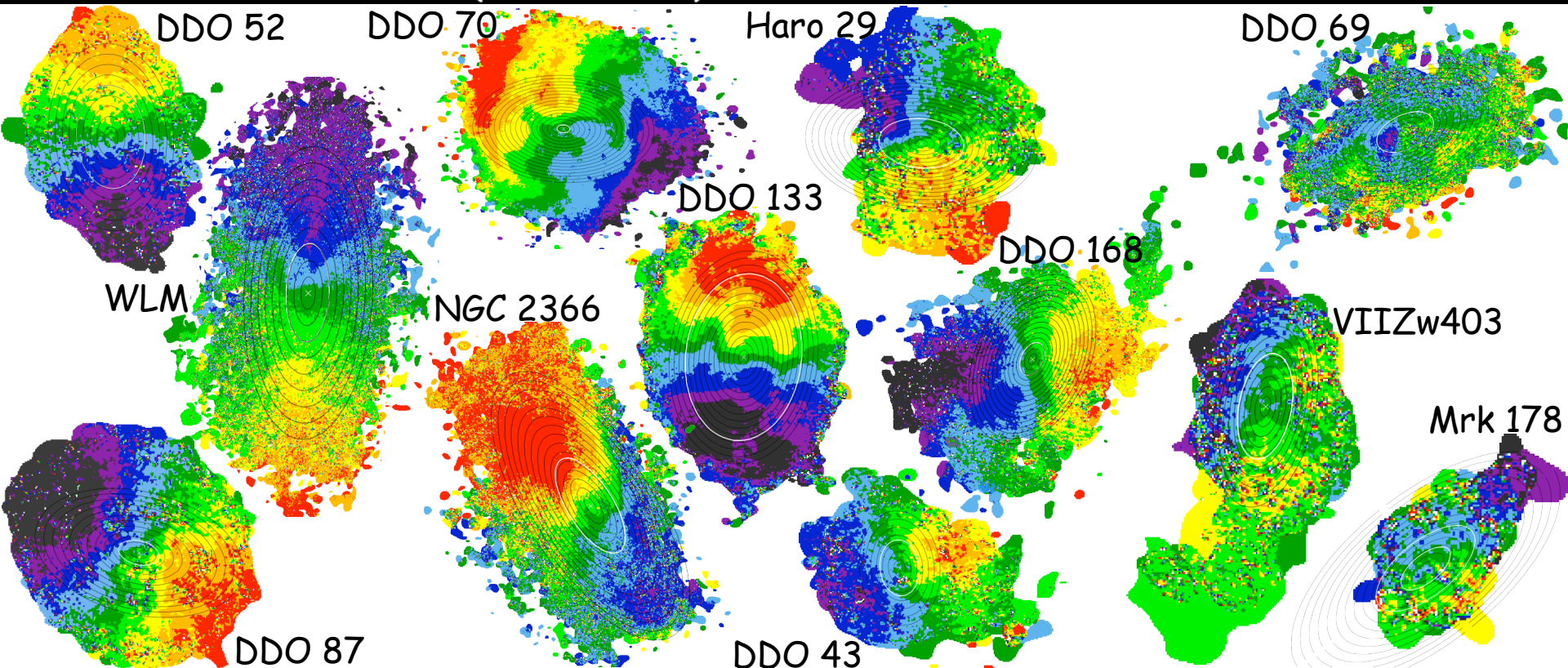
1) Are the optical & kinematic axes aligned?

Yes (15/40)

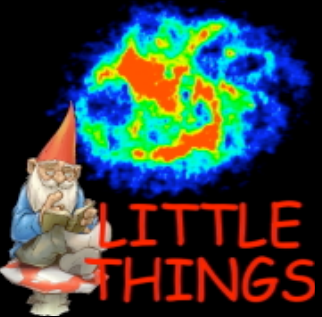
Yes (7/40)
(w/ structure)

No (7/40)

Rotation? (11/40)

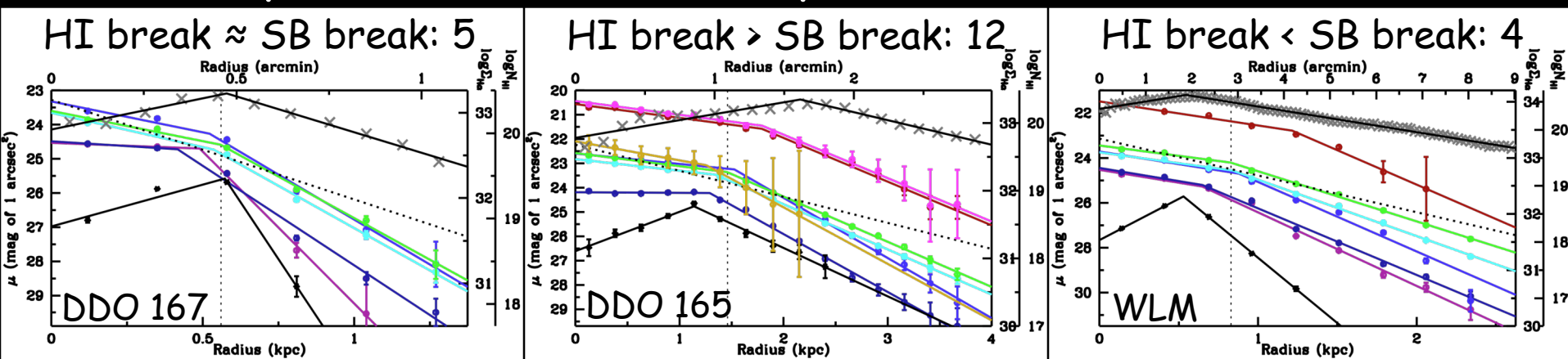


2) Where is the break wrt the rotation curve turnover?

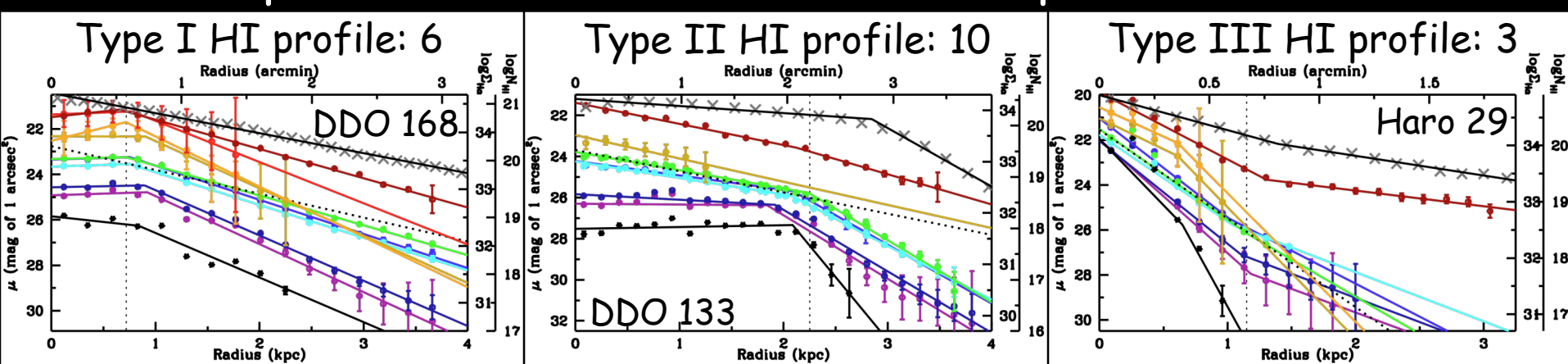


Breaks & LT HI density profiles

21/40 HI profiles have a FI shape (in the SB radial area):

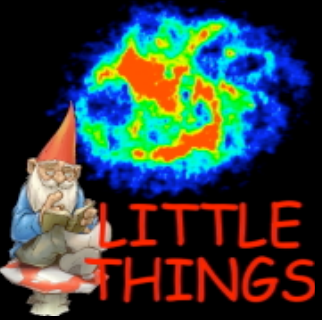


19/40 HI profiles have a I, II, or III shape:



4 similar, 5 farther, 1 closer

3 farther 12/13



Highlights & Future Work

- Dwarfs extend the Profile Type trends with Hubble type
 - Late-types: more IIs; Early-types: more IIIs and Is
- More luminous \rightarrow brighter $\mu_{0,i}$, larger $h_{R,i}$, $h_{R,o}$, R_{br} ; dwarf & spiral trends
- Between IIs and IIIs:
 - Dwarfs: similar outer & break parameters; very different inner parameters
 - Spirals: similar break parameters; very different outer & inner parameters
- $\mu_{br} \sim 24 \text{ mag/arcsec}^2$ in V for dwarfs, spirals, IIs, IIIs...
- For redder bands in dwarfs:
 - IIs: $h_{R,i}$ decreases but $h_{R,o}$ increases
 - IIIs: $h_{R,i}$ increases but $h_{R,o}$ stays the same
 - IIs & IIIs: breaks are relatively independent of wavelength
- Breaks are stronger in bluer bands and in spirals vs. dwarfs (in B&V)
- Dwarf radial color trends do not exactly parallel those of spirals
- What do Mass-to-Light Ratios and Mass Profiles tell us?
- What do HI kinematics and density tell us about breaks?

NRAO, NSF, LT team, friends, family:

Thank you!!!! (and you, too, for listening!)

Questions?