Kinematics of the ionized gas in Luminous Blue Compact Galaxies.

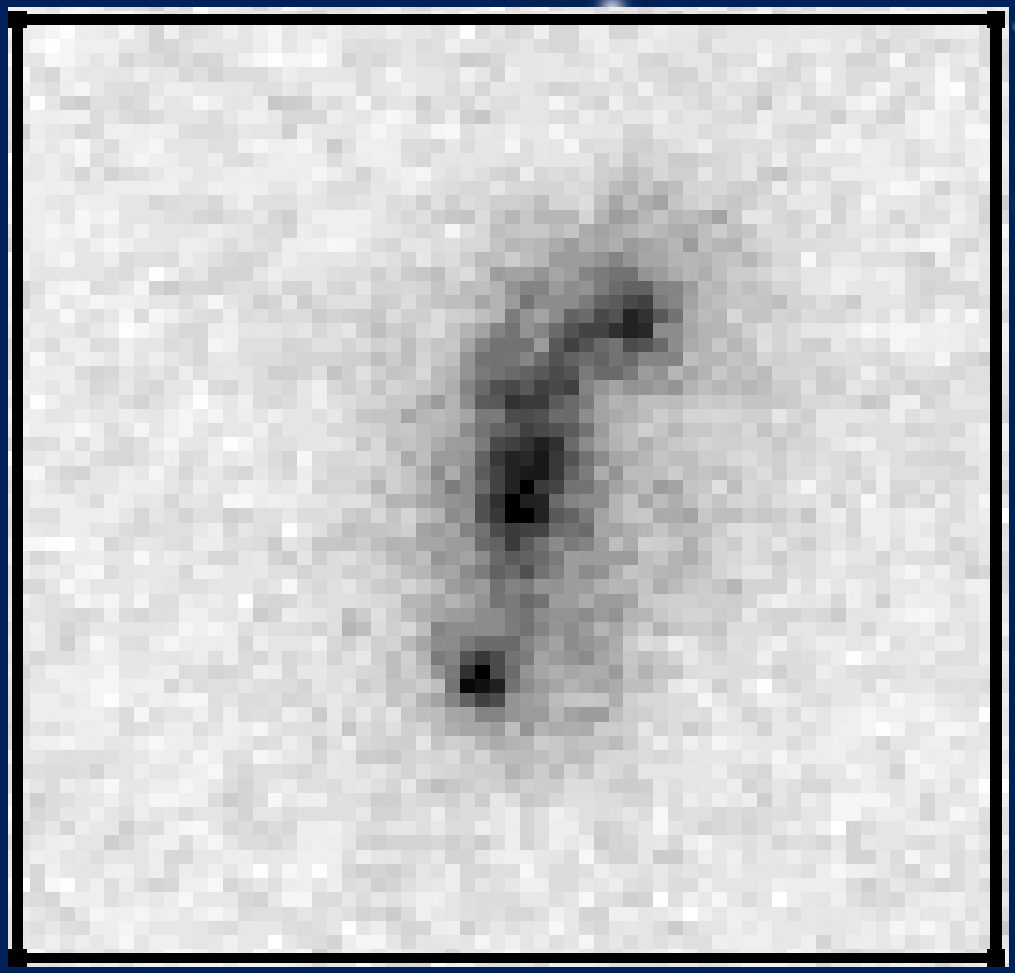


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Brief Presentation of the LCBG class.

These galaxies are:

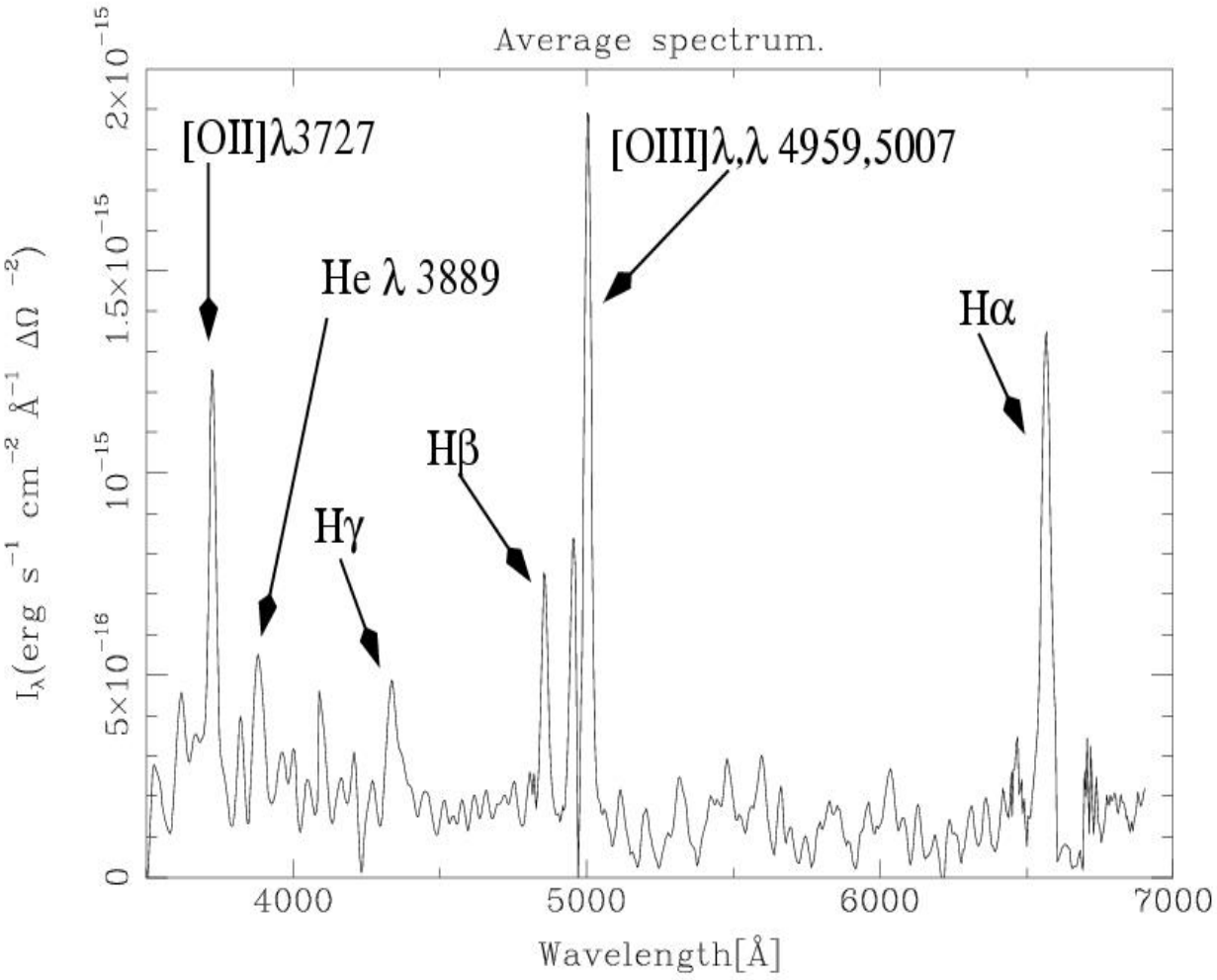
- Luminous (M_B brighter than -17.5)
- Compact (μ_B<21.0)
- Blue (B-V<0.6)
- Galaxies. “Light, what is light?”



I mean this thing.
WFPC2 I814 image of a z=0.4 LCBG.
Image is 3” on a side.

The Objects Studied Here.

The objects we've studied are extreme LCBG in the sense that they are among the smallest, bluest and highest surface-brightness sources. Their integrated gas-phase velocity sigmas are typically 65 km/s. We believe many of these are good candidates for dE progenitors, since their internal kinematics reveal they are dynamically hot, while deep imaging shows they lack outer disks.



Average spectrum of a handful of LCBGs.





Motivations.

- Evolutionary motivations.

It's been suggested that at least a subset of these sources are the progenitors of dEs such as NGC 205, NGC147, NGC3605 and the like. Others argue that LCBGs are bulges in the process of formation. However, part of this confussion is bound to arise from the fact that surveys @intermediate *z* are not uniformly defined, and the objects included span wide ranges in size, color, luminosity, surface-brightness, and morphologies. The broad "LCBG'" class is of course not free from this effect, since their definition is meant to include the most luminous local BCGs as well as various families of starbursts at intermediate *z* such as Lyman-Break galaxies at high *z*.

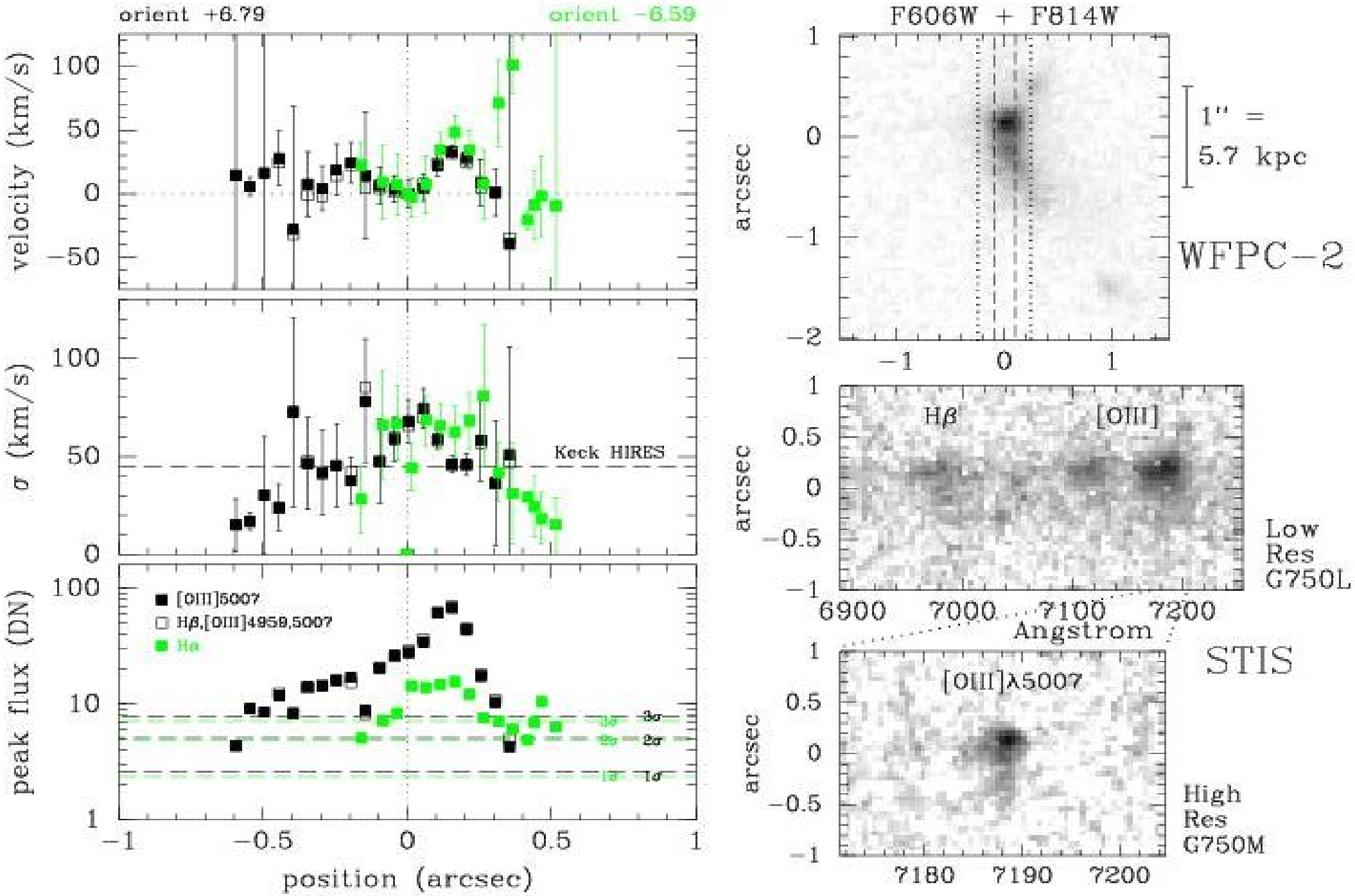
HST spectroscopy.

We've analysed HST data to study these sources. In particular, WFPC2 images and STIS spectroscopy.

Broadly speaking, we used two different configurations of the STIS instrument, low-res modes and high-res modes.

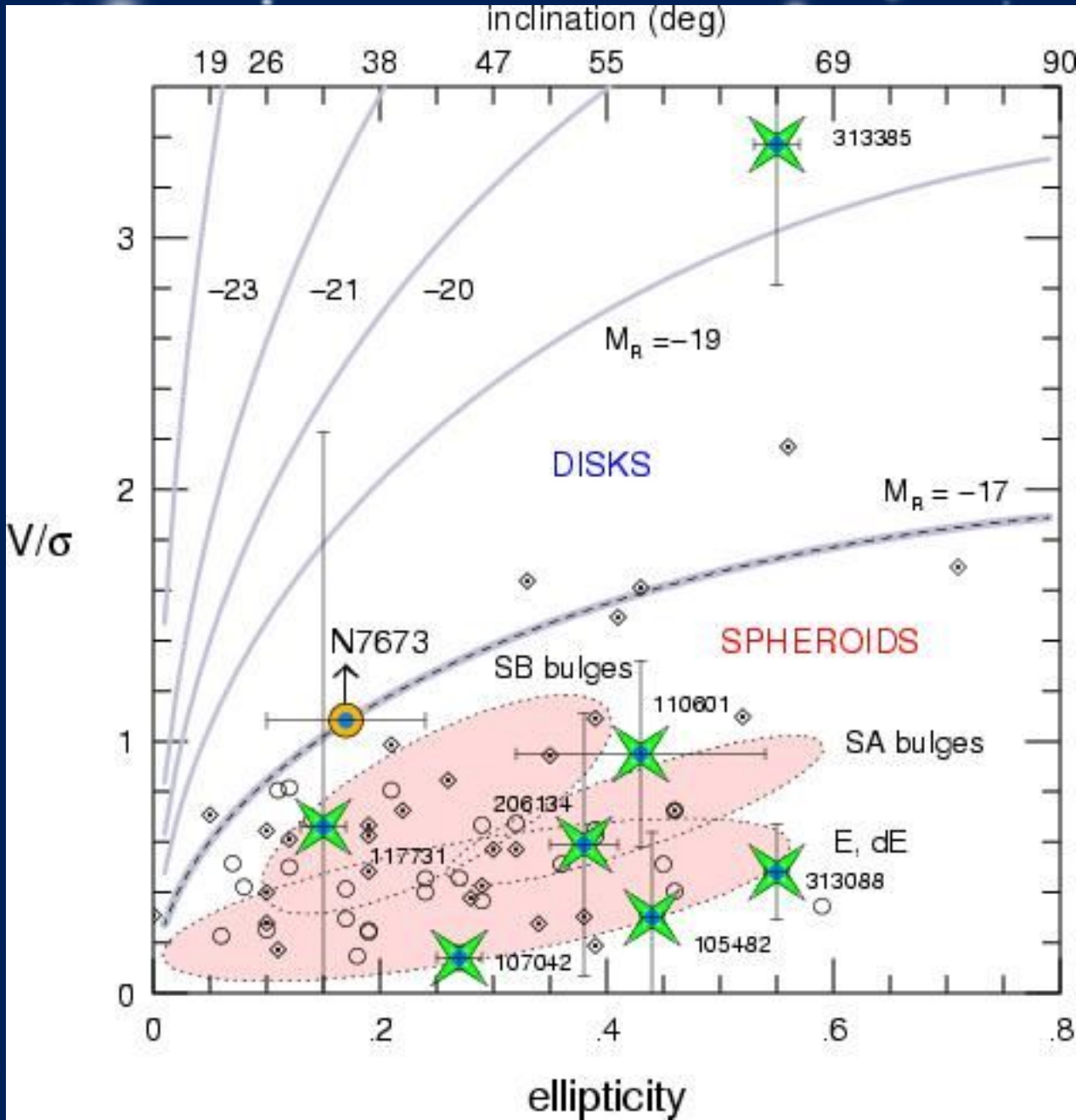
The low res modes were used to derive line ratios, etc. the high res modes were employed to study the kinematics.

The next slide shows an example of the data.


orient +6.79
orient −6.59
velocity (km/s)
σ (km/s)
Keck HIRES
peak flux (DN)
[OIII]5007
Hβ,[OIII]4959,5007
Hα
3σ
2σ
1σ
position (arcsec)
F606W + F814W
arcsec
1" =
5.7 kpc
WFPC−2
Hβ
[OIII]
Low
Res
G750L
Angstrom
STIS
[OIII]λ5007
High
Res
G750M

The temperature of LCBGs.

The lack of rotation coupled with their ellipticity places these sources in the ”spheroidal” region of the V/σ - ellipticity plane. While there is a range of observed V/σ, LCBGs lie well below the region inhabited by disk systems, with values comparable to local dEs andother spheroidals.**LCBGs are dynamically HOT**.

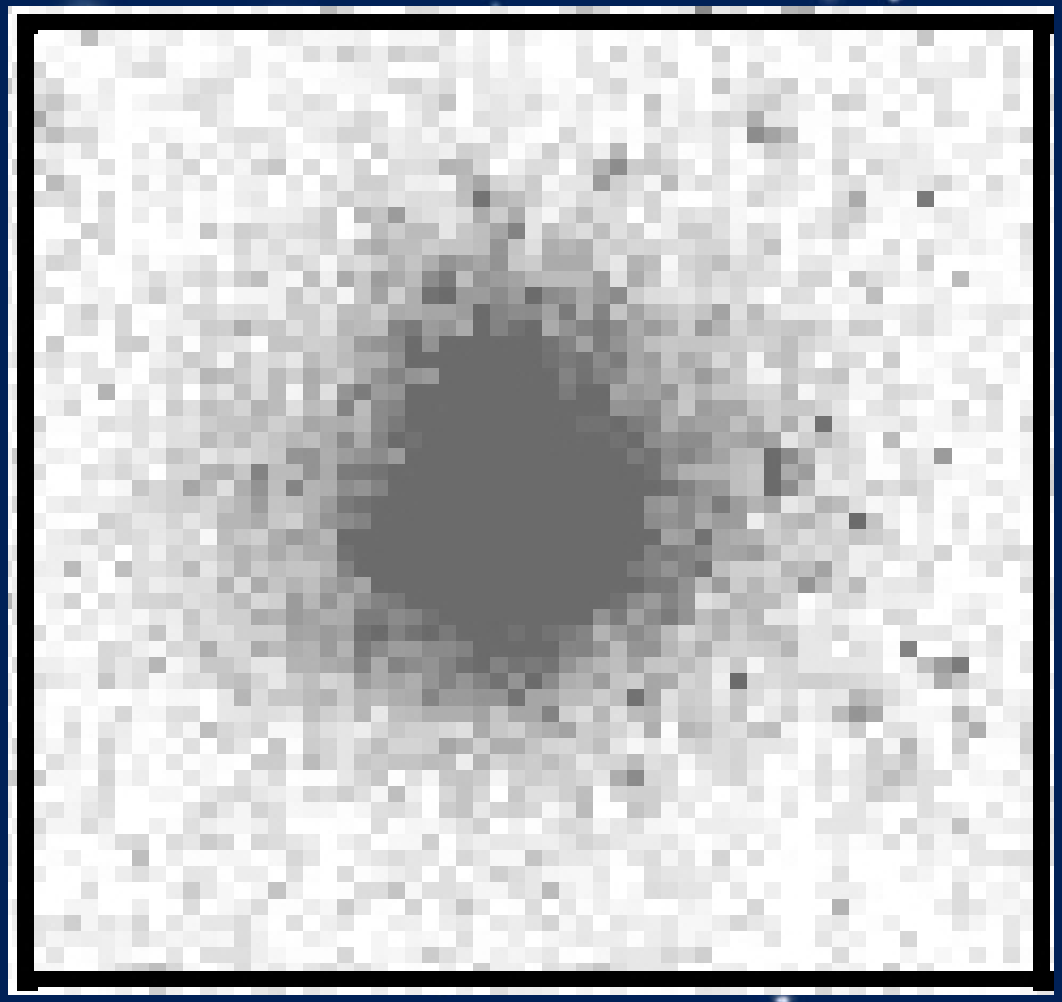


The case of H1-13385.

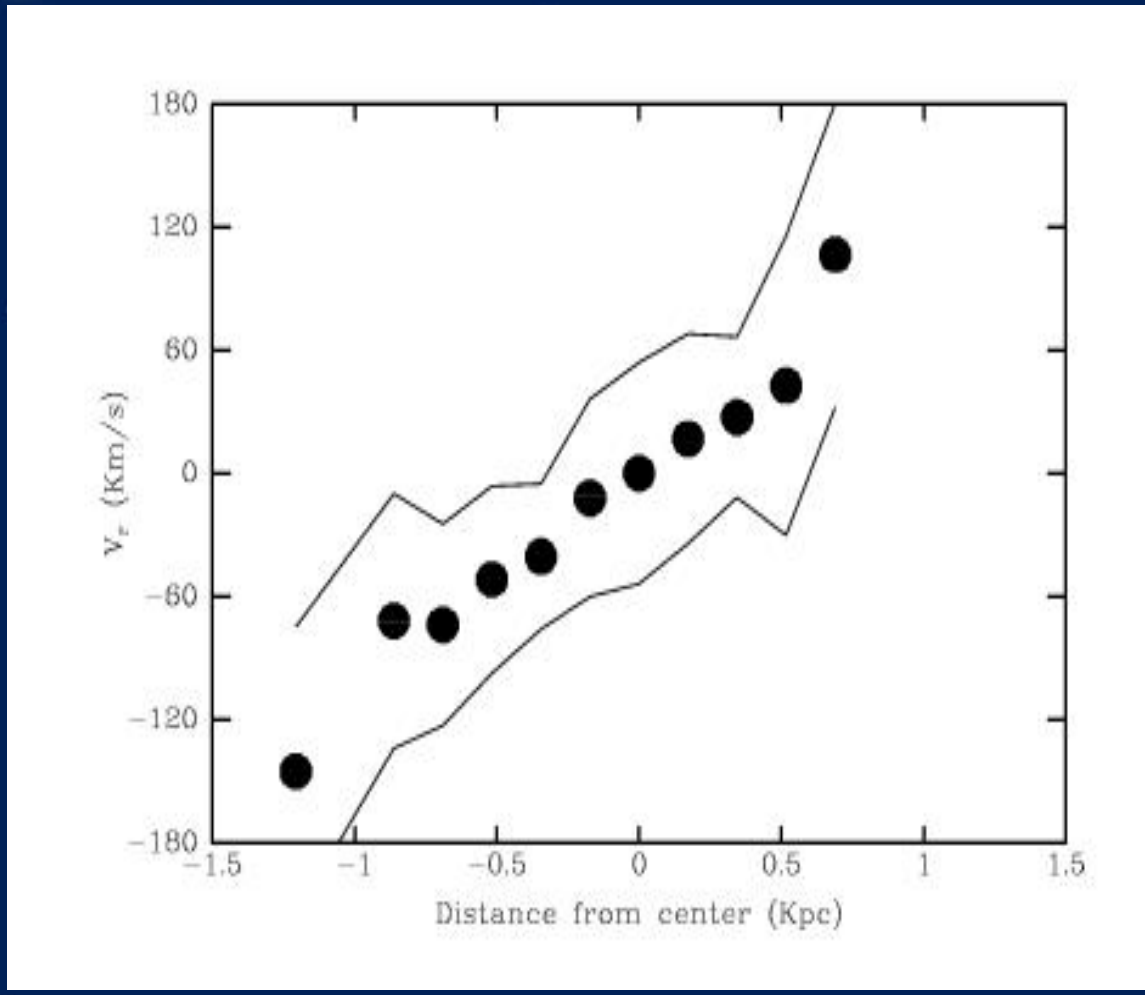
Even though this galaxy is an LCBG, it is special when compared to the rest of the systems presented here because:

- It is **dynamically cold**. It shows a rotation curve.
- Its properties (blue absolute magnitude, line luminosities, surface brightness, and size) are very similar to those of the Large Magallanic Cloud. Isolated, LMC-like systems did exist 2Gyr ago, then. The other LCBGs do not fit so well in the Hubble sequence.
- The observed luminosity profile is exponential. Other IrrMag objects also present small exponential disks like this one.

The case of H1-13385 (con't).

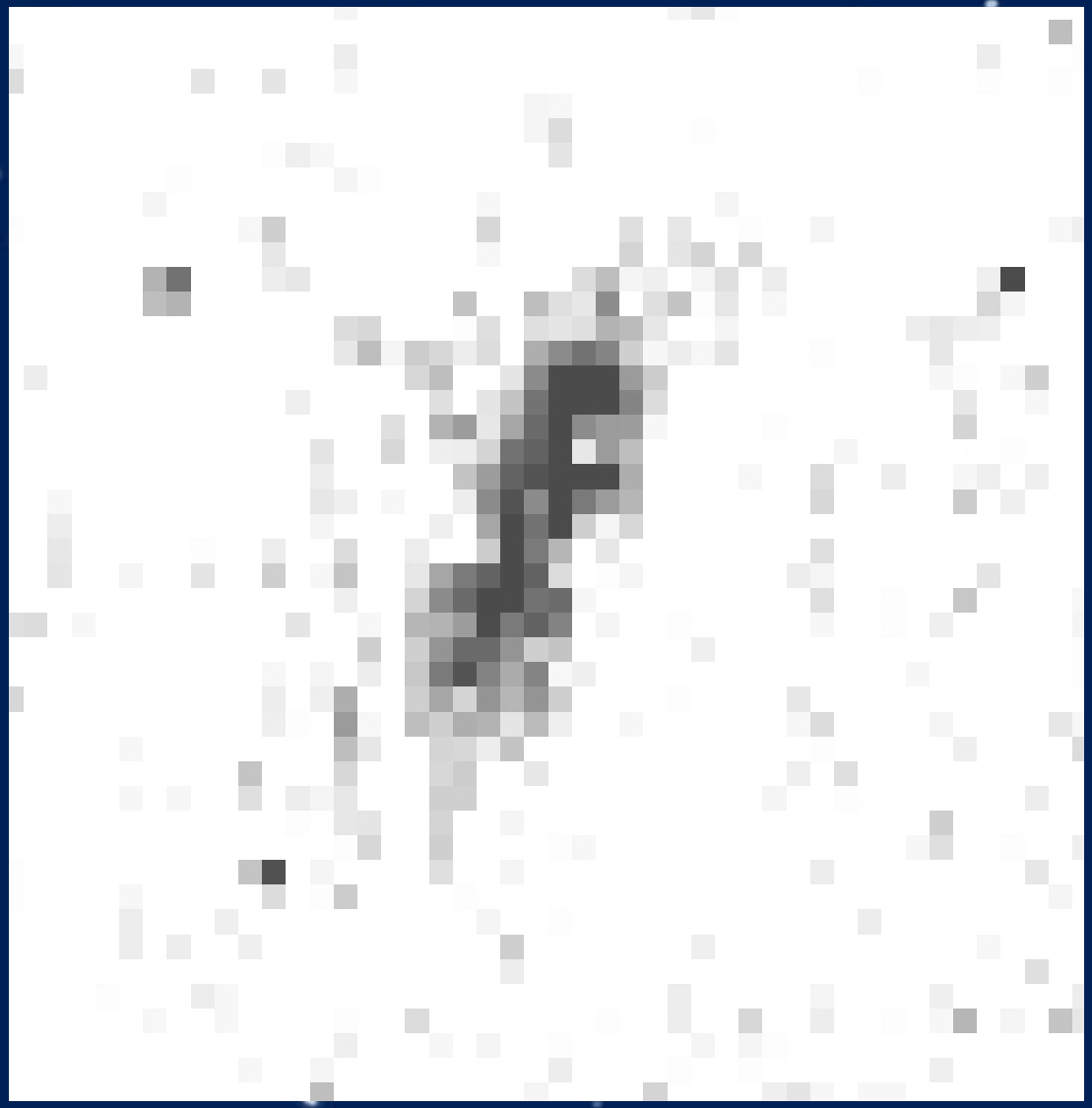


WFPC1 F555W image of H1-13385.z=0.1
Image is 6" on a side.



H1-13385 gas rotation curve. The max rotation speed is 107 km/s. It is very similar to that of the LMC. The LMC RC is in Gondolo (1999).

The case of H1-13385 (con't).



H1-13385 gas rotation curve again. The rotation curve is clearly visible even in the most casual look at the spectra. The resolution is 0.56 Å/px, and the spatial scale is around 3” (or so)

The case of SA68-6134.

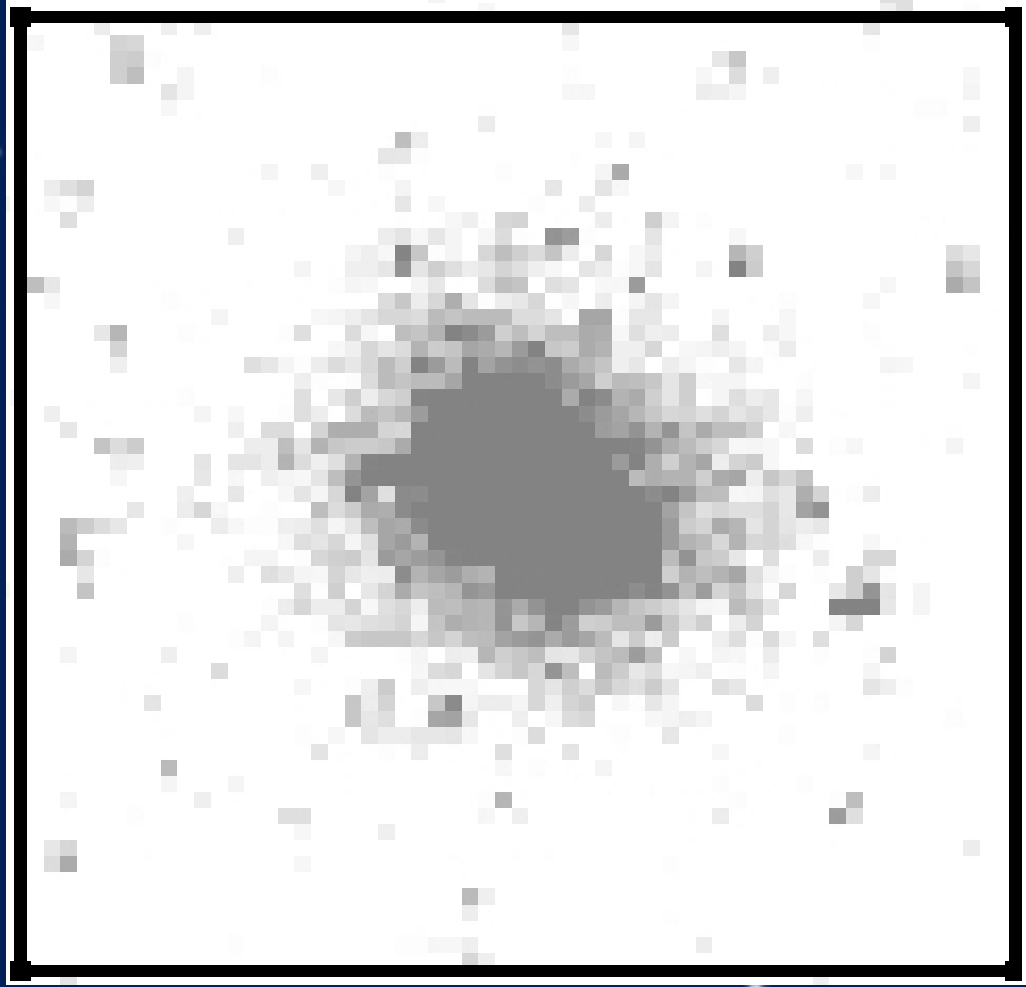


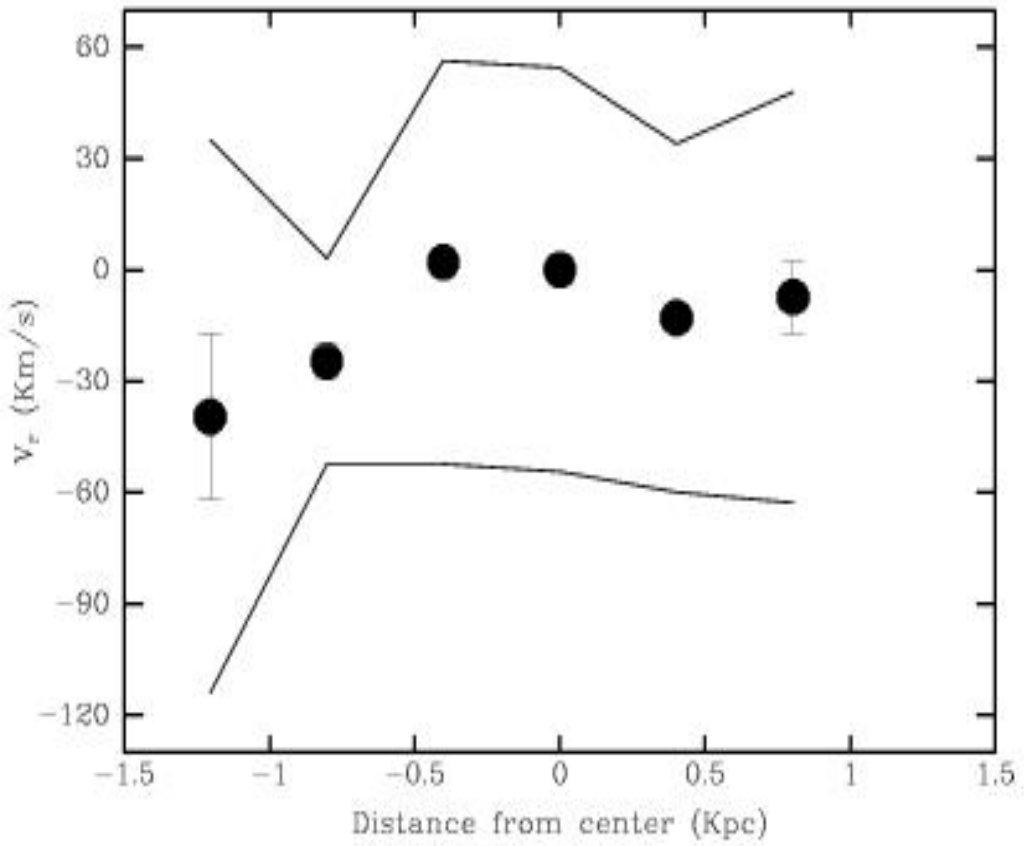


This galaxy is a typical LCBG example.

- It is **dynamically hot**. It does not show a rotation curve.
- Its properties (blue absolute magnitude, line luminosities, surface brightness, and size) are compatible with a wide range of Hubble types. It is more similar to bright HII galaxies. It's very bright, like an L* galaxy, very blue and compact.
- It's to be said that the observed luminosity profile is also exponential.

The case of SA68-6134 (con't)





WFPC1 F555W image of SA68-6134. Image is 6" on a side.z=0.28.

SA68-6134 gas PV curve. This is not a rotation curve. The integrated velocity sigma is dominated by random motions.

Some considerations.

- Do we know that we aren't just sampling a bulge, or a face-on nuclear star-burst? NGC 7673 has been suggested as a nearby example. This source has the right color, surface-brightness, size, luminosity and integrated line-width, and has a faint, extended outer disk. However, Homeier & Gallagher's (1999) Hα velocity map shows clear evidence for rotation in the very inner, star-burst region. We would see similar structure **if it existed** in our STIS spectra. Independently, deep CFHT imaging reveals no strong evidence for extended, normal disks around the types of (and specific) sources presented here.

The mass-to-light ratio of the central kpc of H1-13385 and SA68-6134 are 6.3 and 0.4, respectively. These M/L ratios correspond to very different stellar populations. In the case of SA68-6134, the derived ratio is indicative of a population 4.5×10^8 -10^9 years old. The stellar populations found in H1-13385 are much older, probably older than 5.5×10^9 years. The stellar inventory found in H1-13385 is probably very similar to that found in S0, or early type spiral galaxies. On the other hand, the stars found in the SA68-6134 system are bound to be more similar to the stars found in post-starburst systems. We might be seeing a new starburst on top of yet another starburst not quite extinguished.

Conclussions.

- The evidence presented is against bulge formation and in favor of a dE-like descendant scenario **for 6 out of 7 of the sources presented here**. However, the disturbed morphology and kinematics makes clear cut interpretations difficult. What is the gas really telling us about dynamics? Are these systems in dynamical equilibrium? While their morphology and resolved kinematics would argue otherwise, the agreement between integrated velocity dispersions and resolved profiles indicates the systems cannot be too far out of equilibrium.

- It's been shown that LCBGs come in a wide variety of flavors. The differences in stellar populations and kinematics will have a say in the final destiny of these sources, whatever this destiny turns out to be. The two LCBGs presented here will likely have very different fates.