Extended ionized gas in elliptical galaxies^{*}

II. Velocity and monochromatic maps of 11 elliptical and lenticular galaxies

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Abstract. For the last ten years faint ionized gas detection has been carried out for elliptical galaxies with success. The kinematics is essential to understand galaxy gas origin and fate. Here we present a sample of 11 elliptical and lenticular galaxies observed with the “Cigale” scanning Perot-Fabry instrument. For each galaxy monochromatic and velocity map of ionized gas is presented. Geometrical properties such as viewing angles and axis ratios are also derived from observations. Double gaseous components are found in 3 galaxies of our sample, implying an external origin for at least part of the observed gas.

Key words: galaxies: elliptical and lenticular, kinematics, ISM

- A cold dust component, frequently detected but his role is not well understood (Goudfrooij et al. 1994; Kim 1989).

The ionized gas is a good tracer of potential perturbation, it responds quickly to gravitational variation. It can be located in two preferred planes, one perpendicular to the shortest axis and the other one perpendicular to the longest axis (Tholine 1982; Heiligman et al. 1979). It has been shown that gaseous disks can be used to constrain the true shape of the ellipsoid (de Zeeuw & Franx 1989; Bertola et al. 1991). The 2D velocity field of ionized gas is an important tool to determine viewing angles and axis ratios from observational parameters. Table 1 shows us main characteristics of the galaxy sample. It consists in 11 elliptical and lenticular galaxies: there are nearby (the maximum redshift is 4800 km s^{-1}) in order to have sufficient spatial resolution, there are field and cluster objects in order to see environment influence and all objects have been chosen to have a multiphase ISM (see Table 5).

1. Introduction

Elliptical galaxies were usually known to be gas free, but in the past ten years several surveys have been done using CCD subtraction techniques in order to detect extended gaseous disks (Demoulin et al. 1984; Kim 1989; Buson et al. 1993; Goudfrooij et al. 1994; Macchetto et al. 1996).

In the same way multi-phase Interstellar Medium (ISM) has been discovered in early type galaxies:

- A hot component emitting in X-rays (Forman et al. 1985; Fabbiano et al. 1992),
- A cold component atomic gas (Knapp et al. 1985; van Gorkom et al. 1986) and molecular gas (Lees et al. 1991; Braine et al. 1994),

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^{*} Based on observations collected with the S.A.O. 6 m telescope located in Nizhnij Arkhyz (Russia), the 3.6 m CFH telescope and the 3.6 m telescope at ESO.

2. Observations

Observations were carried out with the Cigale instrument (Boulesteix et al. 1983; Amram et al. 1991) at the 6 m telescope (SAO Russia) between 1991 and 1994, the 3.6 m telescope at ESO in 1990 and 1995 and the 3.6 m telescope at CFH in Hawaii in 1995. IPCS detector was used at the SAO 6 m and ESO 3.6 m telescopes.

For the 6 m telescope observations, CIGALE was attached at the F/4 prime focus and mainly consists of a scanning Perot-Fabry interferometer with a focal reducer, followed by a magnetically focussed Image Photon Counting System (IPCS), giving 512×512 pixels of $30 \mu\text{m}$ on a side (Afanasyev et al. 1987). The final aperture ratio is $f/2.43$ and the pixel sizes are given in Table 3. The IPCS, with a time resolution of $1/50 \text{ s}$ and zero readout noise enables one to scan the interferometer rapidly (typically 10 to 20 s per channel), avoiding sky transparency and seeing

Table 1. Galaxies main characteristics

Name	Coordinates (1950)		Morphological Type (RSA/RC3)	Systemic Velocity (km s ⁻¹)	B_T	Environment
	α	δ				
NGC 404	01 ^h 06 ^m 39.2 ^s	+35°27′06″	SO/SO	-36	10.96	Isolated
NGC 708	01 ^h 49 ^m 50.0 ^s	+35°54′20″	E2/E	4827	13.8	Cluster
NGC 1052	02 ^h 38 ^m 37.4 ^s	-08°28′10″	E3/E4	1470	11.53	Companions
NGC 2974	09 ^h 40 ^m 01.9 ^s	-03°28′15″	E4/E4	1924	11.68	Isolated
NGC 4546	12 ^h 32 ^m 55.0 ^s	-03°31′06″	SB0	1050	11.3	Isolated
NGC 5846	15 ^h 03 ^m 57.0 ^s	+01°47′57″	SO/E0	1709	11.1	Cluster
NGC 5866	15 ^h 05 ^m 07.0 ^s	+55°57′16″	SO	769	10.8	Companions
NGC 5898	15 ^h 15 ^m 17.0 ^s	-23°54′54″	SO/E0	2103	10.8	Companions
NGC 6868	20 ^h 06 ^m 16.0 ^s	-48°31′36″	E3/E2	2876	11.6	Cluster
NGC 7014	21 ^h 04 ^m 29.0 ^s	-47°22′48″	SO	4750	13.38	Companions
NGC 7332	22 ^h 35 ^m 00.1 ^s	+23°32′16″	SO/L	1300	11.58	Companions

variation problems during long exposures.

Calibrations before and after the observation were obtained by scanning the narrow Ne 6599 Å line under the same conditions as the observation, i.e. through the telescope.

For observations at ESO 3.6 m telescope the instrument is slightly the same but the aperture ratio is F/2.5 and the pixel size is 0.91″ on the sky.

For CFHT observations we used SIS focal reducer in FP mode attached at F/8 Cassegrain focus. The CCD detector used was Loral 3 with 7.5 e⁻ of read out noise and pixel size on the sky is 0.68″. Due to the read out noise it is impossible to have short exposures like IPCS, so typical time exposure is basically 5 min for each step and we scan only one cycle.

Different Perot-Fabry etalons were used, depending on the observed wavelength and on the velocity range in the galaxy (Table 2).

Different interference filters were also used to select redshifted emission lines, main characteristics are given in Table 3.

3. Data reduction

The Perot-Fabry reducing software package ADHOC, developed at Marseille’s Observatory (Boulesteix 1993) was used.

3.1. IPCS observations

In the first step individual channel images were added in order to build a data cube and observation cubes were the reduced into a wavelength calibrated cube (x, y, λ). In the second step, the analyze of the detailed profile of the observed line within the free spectral range of the interferometer was done for each pixel. Then night sky and continuum subtractions are computed and velocity, monochromatic and continuum images were extracted.

3.2. CCD observations

First step is to correct each image of the data cube from dark and flat field. It was done using images obtained observing the dome. After the flat field and dark corrections it is necessary to remove cosmic rays and correct the cube from transparency fluctuations and seeing variations. We had considerable changes in air mass during our exposure times often longer than 2 hours. This correction was made using field stars fluxes. To minimize seeing variations during one observation, we have smoothed each scan with a gaussian function with a FWHM equal to the worse seeing that we have in the data cube in order to have the same seeing in each channel. Then this clean cube is proceeded in the same manner as for IPCS observations.

Table 2. Interferometers used for the observations

Identification	reference wavelength	interference order	Finesse	scanned channels	free spectral range (km s ⁻¹)	Spectral resolution
#1	6563 Å	795	25	24	377.4	20 000
#2	6563 Å	501	21	32	598.8	10 000

Table 3. Journal of observations. SAO: 6 m telescope (Russia), ESO: 3.6 m telescope La Silla (Chile), CFHT: 3.6 m telescope Hawaii (USA)

Name	Coordinates (1950)		Date and place of observations	Time Exposure (s)	Interference filter λ central,FWHM	PF Used	Line observed	Pixel size
	α	δ						
NGC 404	01 ^h 06 ^m 39.2 ^s	+35°27′06″	Oct.1993 (SAO)	8000	6559 Å, 13 Å	#2	H α	0.75″
			Oct.1992 (SAO)	9120	6585 Å, 14 Å	#1	[NII] 6584 Å	0.67″
			Aug.1991 (SAO)	7200	5009 Å, 58 Å	#1	[OIII] 5007 Å	0.67″
NGC 708	01 ^h 49 ^m 50.0 ^s	+35°54′20″	Oct.1994 (SAO)	10240	6668 Å, 23 Å	#2	H α	0.92″
			Oct.1994 (SAO)	10880	6687 Å, 26 Å	#2	[NII] 6584 Å	0.92″
NGC 1052	02 ^h 38 ^m 37.4 ^s	-08°28′10″	Oct.1992 (SAO)	17760	6617 Å, 11 Å	#1	[NII] 6584 Å	0.67″
			Oct.1994 (SAO)	13200	6617 Å, 11 Å	#2	[NII] 6584 Å	0.92″
			Oct.1993 (SAO)	13240	6602 Å, 11 Å	#2	H α	0.75″
NGC 2974	09 ^h 40 ^m 01.9 ^s	-03°28′15″	Fev.1995 (CFHT)	9600	6628 Å, 12 Å	#2	[NII] 6584 Å	0.68″
			Fev.1995 (CFHT)	9600	6606 Å, 25 Å	#2	H α	0.68″
NGC 5846	15 ^h 03 ^m 57.0 ^s	+01°47′57″	May.1990 (ESO)	12000	6608 Å, 31 Å	#1	[NII] 6584 Å	0.91″
NGC 5866	15 ^h 05 ^m 07.0 ^s	+55°57′16″	Oct.1992 (SAO)	5760	6586 Å, 14 Å	#1	H α	0.67″
			Oct.1992 (SAO)	7200	6603 Å, 13 Å	#1	[NII] 6584 Å	0.67″
NGC 5898	15 ^h 15 ^m 17.0 ^s	-23°54′54″	Fev.1995 (CFHT)	7040	6611 Å, 10 Å	#2	H α	0.68″
NGC 6868	20 ^h 06 ^m 16.0 ^s	-48°31′36″	Aug.1995 (ESO)	9600	6646 Å, 24 Å	#2	[NII] 6584 Å	0.91″
NGC 7014	21 ^h 04 ^m 29.0 ^s	-47°22′48″	Aug.1995 (ESO)	11400	6694 Å, 27 Å	#2	[NII] 6584 Å	0.91″
NGC 7332	22 ^h 35 ^m 00.1 ^s	+23°32′16″	Oct.1993 (SAO)	8320	6602 Å, 11 Å	#2	[NII] 6584 Å	0.75″
			Oct.1993 (SAO)	8320	6587 Å, 14 Å	#2	H α	0.75″
			Oct.1994 (SAO)	12160	6587 Å, 14 Å	#2	H α	0.92″

3.3. Phase correction

The phase map, obtained from the calibration cubes, is used to calibrate in wavelength observation cubes. The accuracy of the zero wavelength is a fraction of a channel width ($< 3 \text{ km s}^{-1}$) over the whole field.

3.4. Night sky subtraction

In the red spectra (H α , [NII] 6584 Å), it is necessary to subtract the night sky OH lines passing through the narrow filter which are often of the same intensity as the gas emission lines we observe. This is done by determining the OH profile from areas of the field sufficiently far from the center of the galaxy to be supposed free from any galactic emission (Laval et al. 1987).

3.5. Continuum modulation

Even if the width of the filter is large compared to the free spectral range a modulation can appear on observed

spectra, due mainly to the strong continuum of elliptical galaxies. Observation of a continuum lamp was used to correct from this effect.

3.6. Velocities, monochromatic and continuum images

From the individual spectra calibrated in wavelength the continuum map was easily derived and represents for each pixel the value of the mean of the three faintest channels, in order to avoid channel noise effect. To obtain monochromatic images is more delicate because, in the case of multiple components profiles, different maps can be produced for each component. In this case, it is first necessary to decompose multiple profiles in order to build cubes corresponding to each component separately. A gaussian algorithm fitting is used to decompose complex profiles.

Fig. 1. NGC 404: First is red image from Digitalized Sky Survey with North on the top and East on the left. Image total size is 3 arcmin. Second is continuum image of NGC 404 from our observations, SA represents the stellar axis

Fig. 2. NGC 404: **a)** H_{α} monochromatic map, contours are in units of $10^{-17} \text{ erg s}^{-1} \text{ cm}^{-2} \text{ arcsec}^{-2}$. Lowest is 6.6 and step 16.6. **b)** $[\text{NII}]$ 6584 Å map, contours are in same units with lowest level of 7.5 and step 6.6. **c)** $[\text{OIII}]$ 5007 Å map (not calibrated). **d)** Velocity map derived from $[\text{OIII}]$ 5007 Å observation. SA represents the stellar axis

Fig. 3. NGC 404: **a)** Possible viewing angles in the $\theta - \phi$ plane. Case A: gas $\perp$ short axis. Case B gas $\perp$ long axis. **b)** Possible axis ratios for the ellipsoid (S = short, I = intermediate, L = long) in accordance of θ values of showed in **a)**

Fig. 4. NGC 404: **a)** Line of sight velocity diagram for the gas with respect of a $PA = 80^\circ$. **b)** $H\alpha/[NII]$ map, relative lowest level is 80 and step is 30

Fig. 5. NGC 708: Same as NGC 404

Fig. 6. NGC 708: Line of sight velocity diagram of the two gaseous components

Fig. 7. NGC 708 Component #1: **a)** [NII] 6584 Å Monochromatic map. Contours are in units of $10^{-17} \text{ erg s}^{-1} \text{ cm}^{-2} \text{ arcsec}^{-2}$. Lowest 4 and step 2.7. **b)** Velocity map. SA is the stellar axis and GA the gas axis (which is different for velocity and monochromatic maps)

Fig. 8. NGC 708 Component #2: **a)** [NII] 6584 Å Monochromatic map. Contours are in units of $10^{-17} \text{ erg s}^{-1} \text{ cm}^{-2} \text{ arcsec}^{-2}$. Lowest 1.5 and step 1.35 **b)** Velocity map. SA is the stellar axis and GA the gas axis (which is different for velocity and monochromatic maps)

Fig. 9. NGC 708 Component #1: Possible viewing angles **a)** and axis ratios **b)**

Fig. 10. NGC 708 Component #2: Possible viewing angles **a)** and axis ratios **b)**

Fig. 11. NGC 1052: Same as NGC 404

Fig. 12. NGC 1052: Line of sight velocity diagram of the two gaseous components. A: Major component. B: Second component

Fig. 13. NGC 1052 Component #1: **a)** [NII] 6584 Å Monochromatic map. Contours are in units of $10^{-17} \text{ erg s}^{-1} \text{ cm}^{-2} \text{ arcsec}^{-2}$. Lowest 3 and step 7. **b)** Velocity map. SA is the stellar axis and GA the gas axis (which is different for velocity and monochromatic maps)

Fig. 14. NGC 1052 Component #2: **a)** [NII] 6584 Å Monochromatic map. Contours are in units of $10^{-17} \text{ erg s}^{-1} \text{ cm}^{-2} \text{ arcsec}^{-2}$. Lowest 3 and step 7. **b)** Velocity map. SA is the stellar axis and GA the gas axis (which is different for velocity and monochromatic maps)

Fig. 15. NGC 1052: Possible viewing angles for component #1 **a)** and component #2 **b)**. Case A: gas $\perp$ short axis. Case B gas $\perp$ long axis

Fig. 16. NGC 1052: Possible axis ratios for component #1 **a)** and for the hypothesis of $5^\circ < \phi < 15^\circ$ **b)**

Fig. 17. NGC 2974: Field image from Digitalized Sky Survey, total size is 3 arcmin. **a)** Continuum image from our observations. **b)** [NII] 6584 Å monochromatic map. Contours are in units of $10^{-17} \text{ erg s}^{-1} \text{ cm}^{-2} \text{ arcsec}^{-2}$. Lowest 4.1 and step 22.5. **c)** Velocity field. SA represents the stellar axis

Fig. 18. NGC 2974: Line of sight velocity diagram

Fig. 19. NGC 2974: **a)** Possible viewing angles in the $\theta - \phi$ plane. **b)** Possible axis ratios for the ellipsoid (S = short, I = intermediate, L = long) in accordance of θ values of showed in **a)**

Fig. 20. NGC 4546: Field image from Digitalized Sky Survey, total size is 3 arcmin. **a)** Continuum image from our observations. **b)** [NII] 6584 Å monochromatic map. Contours are in units of $10^{-17} \text{ ergs}^{-1} \text{ cm}^{-2} \text{ arcsec}^{-2}$. Lowest 15.6 and step 16.4. **c)** Velocity field. SA represents the stellar axis, GA represents the gas axis

Fig. 21. NGC 4546: Line of sight velocity diagram

Fig. 22. NGC 4546: **a)** Possible viewing angles in the $\theta - \phi$ plane. **b)** Possible axis ratios for the ellipsoid (S = short, I = intermediate, L = long) in accordance of θ values of showed in **a)**

Fig. 23. NGC 5846: Field image from ESO Sky Survey, total size is 3 arcmin. **a)** Continuum image from our observations. **b)** [NII] 6584 Å monochromatic map. Contours are in units of $10^{-17} \text{ erg s}^{-1} \text{ cm}^{-2} \text{ arcsec}^{-2}$. Lowest 7.2 and step 9.64. **c)** Velocity field. SA represents the stellar axis, GA represents the gas axis

Fig. 24. NGC 5846: Line of sight velocity diagram

Fig. 25. NGC 5846: **a)** Possible viewing angles in the $\theta - \phi$ plane. Case A: gas $\perp$ short axis. Case B gas $\perp$ long axis. **b)** Possible axis ratios for the ellipsoid (S = short, I = intermediate, L = long) in accordance of θ values of showed in **a)**

Fig. 26. NGC 5866: Field image from ESO Sky Survey, total size is 3 arcmin. **a)** Continuum image from our observations. **b)** H_α monochromatic map. Contours are in units of $10^{-17} \text{ erg s}^{-1} \text{ cm}^{-2} \text{ arcsec}^{-2}$. Lowest 7.3 and step 7.3. **(c)** $[\text{NII}]$ 6584 Å monochromatic map. Contours are in units of $10^{-17} \text{ erg s}^{-1} \text{ cm}^{-2} \text{ arcsec}^{-2}$. Lowest 19.5 and step 19.5. SA represents stellar axis

Fig. 27. NGC 5866: **a)** $H_\alpha/[\text{NII}]$ map, relative lowest level is 25 and the step 40. **b)** Velocity map of $H_\alpha + [\text{NII}]$ emission. SA is the stellar axis

Fig. 28. NGC 5866: **a)** Possible viewing angles in the $\theta - \phi$ plane. **b)** Possible axis ratios for the ellipsoid ($S = \text{short}$, $I = \text{intermediate}$, $L = \text{long}$) in accordance of θ values of showed in **a)**

Fig. 29. NGC 5866: Line of sight velocity diagram

Fig. 30. NGC 5898: Field image from Digitalized Sky Survey, total size is 3 arcmin. **a)** Continuum image from our observations. **b)** H_α monochromatic map. Contours are in units of $10^{-17} \text{ erg s}^{-1} \text{ cm}^{-2} \text{ arcsec}^{-2}$ Lowest 9.4 and step 16.4. **c)** Velocity field. SA represents the stellar axis, GA represents the gas axis

Fig. 31. NGC 5898: Line of sight velocity diagram

Fig. 32. NGC 5898: **a)** Possible viewing angles in the $\theta - \phi$ plane. Case A: gas $\perp$ short axis. Case B gas $\perp$ long axis. **b)** Possible axis ratios for the ellipsoid (S = short, I = intermediate, L = long) in accordance of θ values of showed in **a)**

Fig. 33. NGC 6868: Field image from Digitalized Sky Survey, total size is 3 arcmin. **a)** Continuum image from our observations. **b)** [NII] 6584 Å monochromatic map. Contours are in units of $10^{-17} \text{ erg s}^{-1} \text{ cm}^{-2} \text{ arcsec}^{-2}$. Lowest 10.0 and step 5. **c)** Velocity field. SA represents the stellar axis, GA represents the gas axis

Fig. 34. NGC 6868: Line of sight velocity diagram

Fig. 35. NGC 6868: **a)** Possible viewing angles in the $\theta - \phi$ plane. Case A: gas $\perp$ short axis. Case B gas $\perp$ long axis. **b)** Possible axis ratios for the ellipsoid (S = short, I = intermediate, L = long) in accordance of θ values of showed in **a)**

Fig. 36. NGC 7014: Field image from Digitalized Sky Survey, total size is 3 arcmin. **a)** Continuum image from our observations. **b)** [NII] 6584 Å monochromatic map. Contours are in units of $10^{-17} \text{ erg s}^{-1} \text{ cm}^{-2} \text{ arcsec}^{-2}$. Lowest 7.5 and step 15. **c)** Velocity field. SA represents the stellar axis, GA represents the gas axis

Fig. 37. NGC 7014: Line of sight velocity diagram

Fig. 38. NGC 7014: **a)** Possible viewing angles in the $\theta - \phi$ plane. Case A: gas $\perp$ short axis. Case B gas $\perp$ long axis. **b)** Possible axis ratios for the ellipsoid (S = short, I = intermediate, L = long) in accordance of θ values of showed in **a)**

Fig. 39. NGC 7332: Same as NGC 404

Fig. 40. NGC 7332: Line of sight velocity diagram of the two gaseous components. A: Major component. B: Second component

Fig. 41. NGC 7332 Component #1: **a)** H α Monochromatic map. Contours are in units of $10^{-17} \text{ erg s}^{-1} \text{ cm}^{-2} \text{ arcsec}^{-2}$. Lowest 3 and step 7. **b)** Velocity map. SA is the stellar axis and GA the gas axis (which is different for velocity and monochromatic maps)

Fig. 42. NGC 7332 Component #2: **a)** [NII] 6584 Å Monochromatic map. Contours are in units of $10^{-17} \text{ erg s}^{-1} \text{ cm}^{-2} \text{ arcsec}^{-2}$. Lowest 3 and step 7. **b)** Velocity map. SA is the stellar axis and GA the gas axis (which is different for velocity and monochromatic maps)

Fig. 43. NGC 7332: Possible viewing angles for component #1 a) and component #2 b). Case A: gas $\perp$ short axis. Case B gas $\perp$ long axis

Fig. 44. NGC 7332: Possible axis ratios for component #1 hypothesis of $5^\circ < \phi < 15^\circ$

Then monochromatic maps are obtained by integrating the monochromatic profile of each component. Velocity maps are computed from the position of the emission line. For interferometer #1, some uncertainty remains, due to the size of the smallest free spectral range and the possible confusion of the orders. Ambiguity is resolved by using other observations (interferometer #2, previous long slit or HI observations).

Monochromatic maps have a one pixel resolution in the center of the galaxies. Spectral profiles have been binned in outer parts (to 5×5 pixels) in order to get a sufficient signal to noise ratio to measure and decompose components.

4. Presentation of the work

From Fig. 1 to Fig. 44, we present results of observations. For each galaxy we give a DSS image, a continuum image, a monochromatic map, a velocity field, a diagram of possible viewing angles, a graph of derived ellipsoid axis ratios and a line of sight velocity curve.

For NGC 404, we have 3 monochromatic maps (H_α , [NII] 6584 Å and [OIII] 5007 Å). A H_α /[NII] map is also available.

For NGC 5866 H_α and [NII] 6584 Å maps are given. H_α /[NII] map was also derived.

Table 3 shows main properties of galaxy sample.

4.1. Geometrical and dynamical aspects

The two dimensional velocity field allows us to derive the true shape of the ellipsoid. Gas disks can be located in 2 preferred planes XY and YZ (Heiligman & Scharzschild 1979; Tholine et al. 1982). Using De Zeeuw & Franx (1989) model it has been possible to derive viewing angles θ and ϕ and possible axis ratios I/L and S/L with S for Short axis, I for Intermediate axis and L for Long axis (Bertola et al. 1991; Plana & Boulesteix 1996). Possible viewing angles and axis ratios are presented on $\theta - \phi$ plane and $I/L - S/L$ plane with hatched regions. To summarize, θ angle represents the inclination angle of the gas disk with respect to the plane of the sky. It is derived from velocity map, fitting a circular motion model to deduce the θ angle. And ϕ angle is the orientation of the gas disk in the triaxial galaxy referential. Inclination value and uncertainties are visualized by a vertical hatched band on $\phi - \theta$ diagrams.

Table 4 summarizes geometrical informations coming from monochromatic and velocity map. Inclination and MA angles can be different for monochromatic and velocity maps. Gas ellipticities were estimated from isophotes where signal to noise ratio is at least 10 and distance to the center is sufficient to avoid any seeing effect. More precisely:

NGC 404 $4''$ to $10''$ i.e. 0.14 to 0.36 effective radius (r_e);
NGC 708 $7''$ to $14''$ i.e. 0.1 to 0.2 r_e

NGC 1052 10'' to 20'' i.e. 0.28 to 0.56 r_e
 NGC 2974 16'' to 20'' i.e. 0.66 to 0.8 r_e
 NGC 4546 7'' to 12'' i.e. 0.26 to 0.44 r_e
 NGC 5846 7'' to 12'' i.e. 0.26 to 0.44 r_e
 NGC 5898 14'' to 18'' i.e. 0.7 to 0.9 r_e
 NGC 6868 12'' to 17'' i.e. 0.5 to 0.51 r_e
 NGC 7014 18'' to 22'' i.e. 1.2 to 1.46 r_e
 NGC 7332 17'' to 22'' i.e. 1.13 to 1.46 r_e .

4.2. Gas masses

Monochromatic maps were calibrated using the literature. We also take $H_\alpha/[NII]$ ratios from articles in order to deduce H_α luminosity when we have $[NII]$ 6584 Å observations. To calculate gas masses we use Case B recombination in Osterbrock 1974.

$$M_{HII} = 2.8 \cdot 10^{-3} \cdot D^2 \cdot F(H_\alpha) \cdot n_e$$

where M_{HII} is expressed in $M_\odot$, $F(H_\alpha)$ in 10^{-14} erg cm $^{-2}$ s $^{-1}$, D in Mpc and n_e in cm $^{-3}$.

It only has been possible to have electron density for a few objects, for the majority of the object we took the value 1000 cm $^{-3}$.

Table 5 gives the different gas masses for hot, warm and cool components. X and radio data are from Roberts et al. (1991) except for NGC 708 for which radio luminosity is from Fanti et al. (1977). Gas masses for HI cold gas and X-ray hot gas are also from Roberts et al. (1991). Far InfraRed (FIR) luminosity has been calculated using IRAS flux at 60 μ and 100 μ and with the formula given in the "Cataloged galaxies and QSO observed in the IRAS survey" from Lonsdale et al. (1989).

$$\text{Log(FIR)} = \text{Log}[1.26(F60) + F(100)]$$

where $F(60) = 2.58 \cdot 10^{-14} \cdot f_{\nu(60)}$ and $F(100) = 10^{-14} \cdot f_{\nu(100)} \cdot f_{\nu(60)}$ and $f_{\nu(100)}$ are IRAS flux density in Jansky.

In Table 5 we give the total mass of the galaxy deduced from the maximum velocity of the line of sight velocity curve (Lequeux 1983). The last column gives the ratio of the ionized gas with respect to the total mass. As we can see ionized gas represents less than $3 \cdot 10^{-6} M_\odot$ for most of the galaxy sample. Exception of NGC 5898 where ionized gas represents more than $5 \cdot 10^{-6} M_\odot$.

4.3. Comments on individual objects

4.3.1. NGC 404

This SO galaxy is characterized by a strong and skewed dust lane (Barbon et al. 1982). HI was detected by Baars et al. (1976), molecular gas was observed by Wiklind & Henkel (1990). The velocity amplitude of the gas is low, ± 40 km s $^{-1}$ and kinematical Major Axis (MA) of the gas is almost aligned with stellar MA. Figure 2 shows monochromatic images in H_α , $[NII]$ 6584 Å and $[OIII]$

5007 Å emission lines. H_α and $[NII]$ 6584 Å extensions are comparable but the $[OIII]$ 5007 Å map shows a larger extension (about 30'') with two distinct lobes.

The weak difference between stellar MA and gas MA explains that the region of possible ϕ viewing angles is very wide. The case with gas perpendicular to the short axis is not constrained and the other case with gas perpendicular to the long axis is marginal. It is very hard to conclude in what plane the gas disk is situated.

Figure 4b shows $H_\alpha/[NII]$ map. It's clear that this ratio is not constant for the total galaxy. The map shows a strong gradient between East and West. The mean value is 2.13 which is consistent with the literature (Kim 1989).

4.3.2. NGC 708

This E2 galaxy belongs to the Abell 262 cluster and it is usually qualified as a Cooling Flow. Baars et al. 1976 have discovered HI in emission but no gas mass has been derived. Molecular gas was also detected by Braine et al. (1994) he gives a superior limit for the mass but this limit is very low for an object who has to accrete $300 M_\odot$ /year in the hypothesis of a cooling flow (Heckman et al. 1989). Observations show a double gaseous component. A monochromatic image and a velocity field have been derived for each of them. Both components are not counter rotating with respect to one another but Position Angles (PA) of the MA of both components are strongly different. The first one has a PA of the MA equal to 137° and the second component has a PA of 42° . So the second component is almost aligned with the stellar component and the first is decoupled with it. The ϕ viewing angle is quite well defined for the first component but for the second one there is no constraint at all.

4.3.3. NGC 1052

This galaxy is a well known E2 elliptical with gaseous disk (Davies et al. 1986). A detailed description of that object has been done by Plana & Boulesteix (1996). It has also been discovered a double gaseous component in that object.

4.3.4. NGC 2974

This isolated galaxy is one of the brightest objects of the sample. HI emission was discovered and an atomic gas disk has been put in evidence by Kim (1988). Ionized gas has been shown by Demoulin et al. (1984), Kim (1989) and Goudfrooij et al. (1994). Ionized gas kinematics has been studied by Bettoni (1992). This object also shows an X-ray emission (Forman et al. 1985). Contrary to most of elliptical galaxies, ionized gas and HI gas components MA of NGC 2974 are aligned with respect to stars. The ϕ viewing angle is not constrained at all because of the small difference between MA of gas and stars. This object is a good candidate for an internal origin of ionized gas.

Table 4. Geometrical properties of galaxies

	Kinematical Major Axis of gas	Morphological Major Axis of gas	Kinematical Inclination	Morphological Inclination	ε	V_{sys} (km s ⁻¹)
NGC 404						
Stars		80° ± 10°			0.05±0.03	-32 ¹
Gas [OIII] 5007Å	73° ± 5°	93° ± 5°	65° ± 3°	56° ± 9°	0.44±0.08	-42 ± 10
Gas [NII] 6584Å	73° ± 5°	95° ± 5°		51° ± 3°	0.37±0.04	-42 ± 10
Gas H α	73° ± 5°	92° ± 5°		48° ± 3°	0.33±0.04	-42 ± 10
NGC 708						
Stars		40° ± 5°			0.4±0.1	4827 ¹
Gas #1 [NII] 6584 Å	138° ± 11°	80° ± 20°	45° ± 9°	45° ± 8°	0.29±0.1	4763 ± 18
Gas #2 [NII] 6584 Å	42° ± 10°	92° ± 20°	63° ± 6°	63° ± 8°	0.55±0.1	4763 ± 18
NGC 1052						
Stars		114° ± 2°			0.26±0.02	1475 ¹ ± 20
Gas #1 [NII] 6584 Å	45° ± 4°	50° ± 5°	47° ± 5°	48° ± 8°	0.34±0.03	1470 ± 5
Gas #2 [NII] 6584 Å	30° ± 28°	120° ± 15°	54° ± 5°	31° ± 9°	0.14±0.03	1480 ± 5
NGC 2974						
Stars		41° ± 1.1°			0.41±0.02	1924 ¹
Gas [NII] 6584Å	45° ± 5°	40° ± 5°	60° ± 5°	55° ± 2°	0.43±0.02	2045 ± 18
NGC 4546						
Stars		78° ± 5°			0.5±0.1	1050 ¹
Gas [NII] 6584Å	64° ± 6°	66° ± 4°	55° ± 3°	53° ± 2°	0.40±0.02	1049 ± 18
NGC 5846						
Stars		85° ± 5°			0.07±0.01	1709 ¹
Gas [NII] 6584Å	140° ± 10°	90° ± 10°	49° ± 5°	20° ± 10°	0.06 ± 0.15	1740 ± 15
NGC 5866						
Stars		127° ± 5°			0.63±0.02	769 ¹
Gas H α	135° ± 11°	130° ± 8°	58° ± 3°	78° ± 1°	0.80±0.02	740 ± 15
Gas [NII] 6584Å	120° ± 7°	130° ± 15°	58° ± 3°	63° ± 1°	0.55±0.02	740 ± 15
NGC 5898						
Stars		36° ± 5°			0.05±0.01	2103 ¹
Gas H α	50° ± 10°	59° ± 6°	68° ± 3°	55° ± 8°	0.42±0.1	2200 ± 18
NGC 6868						
Stars		80° ± 5°			0.13±0.02	2876 ¹
Gas [NII] 6584Å	12° ± 5°	56° ± 10°	52° ± 5°	44° ± 4°	0.28±0.03	2885 ± 20
NGC 7014						
Stars		133° ± 5°			0.2±0.02	4750 ¹
Gas [NII] 6584Å	54° ± 5°	100° ± 10°	56° ± 2°	33° ± 3°	0.16±0.02	4600 ± 20
NGC 7332						
Stars		155° ± 1°			0.73±0.02	1300 ¹ ± 10
Gas #1 H α	140° ± 10°	150° ± 5°	56° ± 10°	67° ± 8°	0.62±0.10	1220 ± 10
Gas #2 H α	172° ± 5°	145° ± 5°	67° ± 10°	49.5° ± 8°	0.35±0.10	1170±10.

Col 1: Name.

Col 2: Gas Major Axis (MA) from velocity map.

Col 3: Gas MA from monochromatic map.

Col 4: Inclination with respect of the plane of sky calculated from velocity map.

Col 5: Inclination with respect of the plane of sky calculated from monochromatic map.

Col 6: Stellar and gas ellipticities. $\varepsilon = 1 - b/a$.

Col 7: Heliocentric velocity.

¹Heliocentric Velocity from Faber et al. (1989).

Table 5. Gas masses. For all objects dust mass, X hot gas mass and HI cold gas mass are from Roberts et al. (1991). X and radio luminosity are from Roberts et al. (1991) except for NGC 708 which radio luminosity is from Fanti et al. (1977)

	D (Mpc) ($H_0 = 75$)	M_B	$\log L(\text{FIR})$ erg s^{-1}	$\log L(\text{X})$ erg s^{-1}	$\log L(\text{radio})$ $\text{erg s}^{-1} \text{ Hz}^{-1}$	Dust Mass $10^4 M_\odot$	Hot Gas Mass $10^8 M_\odot$	HI Mass $10^8 M_\odot$
N 404	10.0	-19.8	42.20	-	-	0.89	-	1.20
N 708	63.1	-21.2	-	-	37.15	-	-	-
N 1052	18.6	-20.9	42.27	40.36	37.53	18.62	-	11.48
N 2974	25.7	-20.1	42.44	40.35	< 36.30	148.00	9.54	15.85
N 4546	12.6	-19.2	41.55	-	35.39	10.90	-	2.57
N 5846	22.3	-20.9	< 41.34	41.33	35.90	< 102.30	66.06	< 0.5
N 5866	12.2	-19.6	42.83	39.60	35.45	145.47	< 22.38	0.37
N 5898	30.9	-19.9	41.78	39.30	< 36.41	< 17.49	< 11.75	< 4.78
N 6868	38.3	-21.2	42.77	-	-	229.08	-	14.12
N 7014	67.0	-20.7	42.84	-	-	-	-	-
N 7332	19.5	-19.8	41.72	39.18	< 35.65	< 5.12	< 6.45	< 2.88

	$F(\text{H}\alpha)$ 10^{-14} $\text{erg cm}^2 \text{ s}^{-1}$	$\log L(\text{H}\alpha)$ erg s^{-1}	HII Gas mass $10^4 M_\odot$	Total mass $10^{10} M_\odot$	Ionized gas/ total mass 10^{-6}
NGC 404	15.0	39.25	0.4	0.60	0.67
NGC 708	2.90	40.14	3.2	14.69	0.22
NGC 1052	57.0	40.37	5.5	1.61	3.40
NGC 2974	17.0	40.13	3.1	1.79	1.73
NGC 4546	9.50	39.26	0.4	0.21	1.90
NGC 5846	21.0	40.10	2.9	1.07	2.71
NGC 5866	110.00	40.29	4.6	2.57	1.79
NGC 5898	32.70	40.57	8.7	1.57	5.54
NGC 6868	14.00	40.39	5.8	4.23	1.37
NGC 7014	7.00	40.58	8.8	7.80	1.13
NGC 7332	54.00	40.39	5.7	3.75	1.52

4.3.5. NGC 4546

This galaxy is classified as an SB0 object. Galletta (1987) and Bettoni et al. (1991) put in evidence ionized gas in this object counter rotating with respect to the stars. We confirm this counter rotation and put constraints on the shape of this object. Viewing angles show that gaseous disks can lie in the ZY plane.

4.3.6. NGC 5846

This is an E0 galaxy in the G50 group with a companion NGC 5846A $1'$ to the south. The presence of atomic gas in that galaxy is not obvious, Roberts et al. (1991) only give a superior limit of HI gas mass ($M_{\text{HI}} = 5 \cdot 10^5 M_\odot$). A strong X-ray emission was detected with Einstein satellite (Forman et al. 1985). Demoulin et al. (1984) have studied the ionized gas component using numerical subtraction technique and results obtained with FP observation are in agreement with this study. The line of sight velocity diagram shows a non axisymmetric rotation, the North West

(200 km s^{-1}) part has a velocity amplitude greater than the South East part (80 km s^{-1}). Viewing angles diagram shows that both Prolate and Oblate possibilities are possible.

4.3.7. NGC 5866

The main characteristic of this SO galaxy is his strong dust lane along the major axis. There are two companions, NGC 5907 and NGC 5879. This object presents a multi-phase ISM: HI was detected by Haynes et al. (1990) but only a superior limit was given for HI mass. X-ray emission has been observed (Roberts et al. 1991; Pellegrini 1994) with an extension of $7.7'$ along the major axis. Ionized gas has been found in that galaxy and the monochromatic map shows an extension of about $40''$ with a major axis almost aligned with respect to the stars. The line of sight velocity diagram shows a non axisymmetric motion. The NW part has a velocity of -200 km s^{-1} lower than the systemic velocity. ϕ viewing angle is not constrained. For this object too we have an $\text{H}\alpha/[\text{NII}]$ map. The mean value

on the ratio is 0.6. In that case too the ratio is not constant but the gradient is lower than in NGC 404.

4.3.8. NGC 5898

This galaxy is an E0 object with a companion (NGC 5903) 5' to the East. Only superior limits are given for HI and X-ray gas masses. Stars are in counter rotation with respect to the ionized gas as shown by Bertola & Bettoni (1988). In that case too, ϕ possible values region is wide (60°), and it is difficult to determine the global shape of the galaxy.

4.3.9. NGC 6868

This galaxy is classified as an E3 galaxy in the RC3 catalog and as an E2 in the RSA catalog. It belongs to the GR28 group with four other galaxies (Maia et al. 1989). Cold ISM is present with HI gas, but Roberts et al. (1991) give only a superior limit for the HI gas mass. NGC 6868 is the host galaxy of a radio source PKS 2005–489 (Savage et al. 1977). It was also detected with IRAS satellite in 60 μ m and 100 μ m. Ionized gas has been put in evidence in spectroscopy by Phillips et al. (1986) and with CCD imaging by Hansen et al. (1991), Buson et al. (1993) and Macchetto et al. (1996). The line of sight velocity diagram shows a flat curve with a velocity amplitude of ± 150 km s $^{-1}$. Possible viewing angles diagram show us that the more probable location plane of the gaseous disk is the XY plane (perpendicular to the short axis). The ϕ angle is more constrained with this possibility ($5^\circ < \phi < 15^\circ$). Possible axis ratios are also shown.

4.3.10. NGC 7014

It is classified as an SO object in the RC3 catalog. A companion is present 7' to the west. No informations are available in radio or X-rays domain, only dust has been put in evidence (Sparks et al. 1985), ionized gas has been observed by spectroscopically by Phillips et al. (1986). The monochromatic map shows a complex structure with a strong gradient. The line of sight velocity diagram shows a non axisymmetric motion, the NE branch has a velocity amplitude higher than the SW branch. We also notice that in the SW direction beyond 10'', velocities are much spread out. On the geometry point of view, it seems that the Oblate possibility is the more probable with $20^\circ < \phi < 60^\circ$ and $54^\circ < \theta < 58^\circ$.

4.3.11. NGC 7332

This object is classified as an SO galaxy in the RC3 catalog. We have observed a complex system of two gaseous components. A detailed study is presented by Plana & Boulesteix (1996).

Fig. 45. H_α luminosity versus B absolute magnitude. The dashed lines represent Phillips et al. (1986) sample

5. Global analysis

5.1. Photometry

In this section we have tried to get an overall idea of the sample. Informations given previously allow us to investigate the spatial gas distribution and ionized gas mass/total mass ratio. We first look at H_α luminosity repartition with respect to the B absolute magnitude. This is shown in Fig. 45 H_α has been derived from monochromatic maps and using $H_\alpha/[NII]$ ratio found on literature (Phillips et al. 1986; Goudfrooij et al. 1994). It appears that H_α luminosity is 10 to 100 times more important than Phillips et al (1986) sample of emission line ellipticals detected by spectroscopy, which is consistent with Buson et al. (1993) study.

Monochromatic maps give us the gas distribution along the major axis. This extension varies considerably for the different galaxies. Figure 46 shows the radial surface brightness of the 11 galaxies for the gas and stars. The extension is different and the slope is different too, between the gas and the stars and between galaxies. In order to compare the gas surface brightness slope, an intensity gradient index has been introduced. It is derived from the intensity profile with as $I = f(r^{-n})$ with n in the range 1-2. Figure 47 shows the normalized gas extension ($[NII]$ 6584 Å) versus the intensity gradient index. We can see that for a given gradient index, SO galaxies seem to have a larger gas extension.

5.2. Geometry

The geometrical aspect is the other major point of our study. Table 6 summarizes possible viewing angles (θ and ϕ) and possible axis ratios (I/L and S/L) derived from velocity fields and using de Zeeuw & Franx model (1989). Our sample can be divided in 3 parts for the geometrical point of view.

Fig. 46. Surface brightness of the ionized gas and the stars. The vertical dashed line represent the effective radius. Cross represent the gas brightness and continue line is the stellar brightness

- Galaxies with 2 gas components: NGC 708, NGC 1052 and NGC 7332.

NGC 708 shows a component almost aligned with the stars and another strongly decoupled. For the first component ϕ angle is not strongly constrained but it is enough to think that the gas disk is lying on the ZY plane (perpendicular to the long axis). For the second component the ϕ angle is not constrained at all and only the prolate shape seems to be possible. In that

condition it is difficult to give gas disks location. NGC 1052 and NGC 7332 cases have been discussed in a previous paper (Plana & Boulesteix 1996). To summarize, component 1 of NGC 1052 have high probability to be located on XY plane but it is doubtful to have the second component on ZY plane, because of the none common values of axis ratios for that hypothesis. Situation for NGC 7332 is quite the same with simple

way to find both components in the two perpendicular planes.

- Galaxies with no constrained ϕ angle: NGC 404, NGC 2974, NGC 5866 and NGC 5898.

For that objects, the gas velocity field MA is almost aligned with the stellar MA. The consequence is a wide region allowed for the ϕ angle.

- Galaxies with good constraint on ϕ angle: NGC 4546, NGC 5846, NGC 6868 and NGC 7014.

In that case several possibilities are encountered:

Good ϕ determination and one possibility for the gas location: NGC 4546 $\phi = 57 \pm 5$ in a Prolate case.

Good ϕ determination but two possibilities for the gas location: NGC 5846 $\phi = -22 \pm 15$ in a Prolate case and $\phi = 67^\circ \pm 12^\circ$ in a Oblate case.

Good ϕ determination, two possibilities for gas location but one more probable than the other:

NGC 6868 $\phi = 12^\circ \pm 5^\circ$ in a Prolate case.

NGC 7014 $\phi = 5^\circ \pm 3^\circ$ in a Prolate case.

As we can see, the ϕ viewing angle determination is strongly dependant of the misalignment between gas and stars MA.

Fig. 47. Normalized gas extension (in unit of r_e) versus the intensity gradient index

6. Conclusion

This paper presents scanning Perot-Fabry observations of ionized gas in 11 elliptical and lenticular galaxies. We show monochromatic and velocity maps for each object. Using the model developed by de Zeeuw and Franx in 1989, we could give informations about the geometrical aspect of the triaxial ellipsoid such as viewing angles and axis ratios. But this calculation gives interesting results (narrow possible viewing angles regions) only if gas and stars major axis are not aligned, if not regions are too wide to give any valuable information. Three galaxies of our sample show a

Table 6. Viewing angles: θ , ϕ and axis ratios I/L , S/L . For each galaxy we give the both possibilities Oblate or Prolate when it is possible. Note: the θ angle is the same as the inclination angle deduced from velocity map in Table 4

Name	Viewing Angles		Axis Ratios	
	θ	ϕ	I/L	S/L
NGC 404				
Prolate:	$65^\circ \pm 3^\circ$	$35^\circ \pm 25^\circ$	0.75 ± 0.25	0.65 ± 0.15
Oblate:	$65^\circ \pm 3^\circ$	$85^\circ \pm 5^\circ$	-	-
NGC 708				
Compo #1	-	-	-	-
Prolate:	-	-	-	-
Oblate:	$45^\circ \pm 5^\circ$	$-35^\circ \pm 25^\circ$	0.75 ± 0.25	0.45 ± 0.5
Compo #2				
Prolate:	$55^\circ \pm 5^\circ$	$-55^\circ \pm 35^\circ$	0.77 ± 0.17	0.45 ± 0.5
Oblate:	-	-	-	-
NGC 1052				
Compo #1				
Prolate:	$47^\circ \pm 5^\circ$	$13^\circ \pm 3^\circ$	0.55 ± 0.05	0.50 ± 0.15
Oblate:	$47^\circ \pm 5^\circ$	$48^\circ \pm 20^\circ$	0.80 ± 0.20	0.52 ± 0.17
Compo #2				
Prolate:	$54^\circ \pm 5^\circ$	$3^\circ \pm 1^\circ$	0.62 ± 0.15	0.45 ± 0.15
Oblate:	$54^\circ \pm 5^\circ$	$45^\circ \pm 35^\circ$	0.90 ± 0.10	0.70 ± 0.05
NGC 2974				
Prolate:	$60^\circ \pm 5^\circ$	$-45^\circ \pm 25^\circ$	0.75 ± 0.15	0.45 ± 0.15
Oblate:	-	-	-	-
NGC 4546				
Prolate:	$55^\circ \pm 3^\circ$	$57^\circ \pm 5^\circ$	0.57 ± 0.07	0.38 ± 0.10
Oblate:	-	-	-	-
NGC 5846				
Prolate:	$49^\circ \pm 5^\circ$	$-22^\circ \pm 15^\circ$	0.74 ± 0.12	0.60 ± 0.3
Oblate:	$49^\circ \pm 5^\circ$	$-67^\circ \pm 12^\circ$	0.85 ± 0.15	0.60 ± 0.3
NGC 5866				
Prolate:	$58^\circ \pm 3^\circ$	$45^\circ \pm 45^\circ$	0.79 ± 0.17	0.45 ± 0.15
Oblate:	-	-	-	-
NGC 5898				
Prolate:	$58^\circ \pm 3^\circ$	$-30^\circ \pm 30^\circ$	0.70 ± 0.20	0.60 ± 0.3
Oblate:	-	-	-	-
NGC 6868				
Prolate:	$52^\circ \pm 5^\circ$	$12^\circ \pm 5^\circ$	0.65 ± 0.10	0.55 ± 0.22
Oblate:	$52^\circ \pm 5^\circ$	$55^\circ \pm 22^\circ$	0.84 ± 0.17	0.57 ± 0.27
NGC 7014				
Prolate:	$56^\circ \pm 2^\circ$	$5^\circ \pm 2^\circ$	0.47 ± 0.03	0.40 ± 0.05
Oblate:	$56^\circ \pm 2^\circ$	$37^\circ \pm 22^\circ$	0.82 ± 0.17	0.47 ± 0.17
NGC 7332				
Compo #1				
Prolate:	$56^\circ \pm 10^\circ$	$60^\circ \pm 10^\circ$	0.35 ± 0.1	0.15 ± 0.1
Oblate:	-	-	-	-
Compo #2				
Prolate:	$67^\circ \pm 10^\circ$	$42.5^\circ \pm 17^\circ$	0.30 ± 0.1	0.12 ± 0.07
Oblate:	-	-	-	-

complex system of double gaseous components: NGC 708, NGC 1052 and NGC 7332. The presence of such multiple components addresses the question of gas origin and fate. This implies an external origin of the gas, at least for a part of the gas content. One scenario is to imagine that the galaxy had several encounters during his life. The case of NGC 708 is certainly the most interesting, because one component is aligned with the stars and the other is decoupled. In that case the cooling flow hypothesis can not explain the presence of such gaseous components. On another hand two objects, NGC 404 and NGC 2974 show a perfect agreement between gas and stars which can be candidates for internal origin.

Monochromatic maps give us the possibility to have ionized gas masses. The range of the masses is between $4 \cdot 10^3 M_{\odot}$ and $9 \cdot 10^4 M_{\odot}$, which is few in comparison with the total mass of the galaxy estimated from the maximal gas velocity (cf. Table 5). As Buson et al. (1993) analysis, our sample shows that H_{α} luminosity is 10 to 100 times larger than the spectroscopic survey from Phillips et al. (1986). It can mean that galaxies gas content is simply larger or that a higher fraction of gas has been ionized. The gas distribution is also quite different between galaxies. In a forthcoming paper we will discuss more deeply the interpretation we can give for galaxy shape and orientation of elliptical galaxies.

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