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Kinematical data on early-type galaxies. III.⋆,⋆⋆

F. Simien and Ph. Prugniel

CRAL-Observatoire de Lyon (CNRS: UMR 142), F-69561 St-Genis-Laval Cedex, France

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Abstract. We present new kinematical data for a sample of 24 early-type galaxies. Rotation curves and velocity-dispersion profiles are determined for 21 objects, while the central velocity dispersions are given for the whole sample. This is our third paper in a series devoted to the presentation of kinematical data on elliptical and S0 galaxies, derived from long-slit absorption spectroscopy.

Key words: galaxies: elliptical & lenticular, cD — galaxies: kinematics and dynamics — galaxies: fundamental parameters

1. Introduction

We have recently begun to present kinematical measurements from absorption spectroscopy on early-type galaxies (Simien & Prugniel 1997a,b, hereafter Papers I and II, respectively); these data are intended to contribute to the study of several structural and evolutionary issues. As part of our continued effort to get reliable velocity dispersions and rotation curves on a statistically significant sample of objects, we presently report on observations on a third list of targets.

This work follows closely the technique already described in full detail in Paper I, for both observation and reduction, and only a minimum of explanations will be given here.

2. Sample and observations

Our present sample consists of 24 early-type galaxies, with nine ellipticals and 15 S0s. This set adds up to the 21-object and 38-object samples of Papers I and II; there are four objects in common with Paper I and two with Paper II: these additional measurements have been included in the present work for comparison purposes. Relevant catalog elements are presented in Table 1. The Es have ellipticities corresponding to classes between $\simeq$ E1 and $\simeq$ E4, and the S0s are moderately to highly flattened. The distances are in the range of $\simeq 10$ to $\simeq 74$ Mpc (for $H_0 = 75\,\mathrm{km\,s^{-1}\,Mpc^{-1}}$). These objects are intrinsically bright ($-22.1 < M_B < -18.9$).

The observations have been secured at the 1.93-m telescope of the Observatoire de Haute-Provence, equipped with the *CARELEC* long-slit spectrograph. In November 1993, November and December 1994, three observing runs totalling 10 nights collected spectra on the major axis of the galaxies and, for five of them, on the minor axis as well.

The atmospheric conditions were variable, with a seeing disk between $2''$ and $3.5''$ (FWHM) for most objects, but up to $\simeq 5''$ for three of them. The log of the observations is given in Table 2, which is proposed in electronic form only.

3. Data reduction

As in Papers I and II, standard pre-processing was applied to the raw data, up to the rebinning in wavelength. The galaxy centers ($r = 0$) were determined by a Gaussian fitting to a limited range ($\simeq 12''$) around the brightest line. In the outer regions, cosmic-ray hits were removed with a median filter, and adjacent lines were combined with a variable weighting function (a Gaussian continuously wider faintward). A Fourier-Fitting technique determined the central velocity dispersion σ_0 and, when possible, the radial profile $\sigma(r)$ of the dispersion, together with the projected rotation curve $V(r)$ along the major axis. A two-pass mode (described in Paper I) allowed to remove cosmics on the inner lines, where the spatial resolution must be preserved. We adopted as the systemic velocity the value measured at $r = 0$. Whenever possible, we have determined the maximum rotation velocity $V_{\max}$, as the mean of representative values on the opposite semi-axes.

Send offprint requests to: F. Simien (simien@obs.univ-lyon1.fr)

⋆ Based on observations collected at the Observatoire de Haute-Provence.

⋆⋆ Tables 2 and 4 are presented in electronic form only; Tables 1 through 4 are available from the CDS, Strasbourg (anonymous ftp to cdsarc.u-strasbg.fr (130.79.128.5) or via http://cdsweb.u-strasbg.fr/Abstract.html)

Table 1. Catalog elements

Object	Type	α_{1950}	δ_{1950}	$v_{\rm hel}$	$B_{\rm T}$	$-M_B$	$r_{\rm e}$	ϵ	PA	ref.	σ_0	$V_{\rm max}$
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
NGC 0499	−3	01 20 22.4	+33 11 57	4375	12.96	20.75	14.9	0.23	82	4	237 ±24	... ± ...
NGC 0584	−5	01 28 50.2	−07 07 32	1869	11.29	20.44	24.5	0.34	59	1	225 ±12	157 ± 11
NGC 0680	−4	01 47 01.4	+21 43 22	2932	12.39	20.28	18.5	0.21	174	1	215 ±14	... ± ...
NGC 0890	−3	02 19 02.2	+33 02 17	4005	11.85	21.52	31.8	0.46	55	1	229 ±14	< 100 ± ...
NGC 0990	−5	02 33 36.1	+11 25 27	3508	13.10	20.00	18.1	0.19	43	1	176 ±22	... ± ...
NGC 1016	−5	02 35 44.4	+01 54 09	6583	12.25	22.09	51.1	0.09	59	1	280 ±19	... ± ...
NGC 1023	−3	02 37 15.8	+38 50 55	600	10.21	19.94	38.9	0.58	87	4	213 ±15	240 ± 36
NGC 1060	−3	02 40 13.9	+32 12 47	5190	12.06	21.86	39.5	0.25	68	1	303 ±29	... ± ...
NGC 1175	−1	03 01 15.5	+42 08 43	5540	13.23	20.85	10.2	0.65	153	4	235 ±30	160 ± 24
NGC 1209	−5	03 03 42.9	−15 48 15	2617	12.14	20.15	23.2	0.46	82	1	241 ±21	175 ± 26
NGC 1521	−4	04 06 08.0	−21 10 59	4172	12.32	21.22	34.7	0.22	19	1	236 ±36	... ± ...
NGC 1573	−5	04 29 03.2	+73 09 33	4220	12.53	21.03	22.1	0.31	35	4	286 ±35	... ± ...
NGC 1653	−4	04 43 16.5	−02 28 53	4338	12.60	20.92	25.4	0.08	118	1	253 ±55	... ± ...
NGC 1726	−2	04 57 16.0	−07 49 42	4008	12.32	21.20	29.9	0.29	7	1	236 ±16	40 ± 10
NGC 2314	−5	07 03 53.7	+75 24 28	3848	12.92	20.51	10.9	0.12	25	4	290 ±13	... ± ...
NGC 2340	−5	07 07 20.4	+50 15 24	5949	12.38	21.96	52.0	0.33	8	4	253 ±25	... ± ...
NGC 2549	−2	08 14 56.6	+57 57 34	1069	11.93	19.33	21.3	0.70	177	2	155 ±16	150 ± 30
NGC 2685	−1	08 51 41.2	+58 55 29	869	11.94	19.06	30.1	0.53	38	4	103 ±17	< 100 ± ...
NGC 2732	−2	09 06 52.8	+79 23 33	1973	12.64	19.54	17.1	0.38	67	2	160 ±18	129 ± 14
NGC 2768	−4	09 07 45.2	+60 14 39	1334	10.74	20.86	61.1	0.68	95	3	193 ±11	78 ± 34
NGC 7332	−2	22 35 01.2	+23 32 16	1202	11.94	18.98	11.5	0.55	156	1	136 ±16	136 ± 14
NGC 7457	−3	22 58 36.1	+29 52 31	813	11.21	18.93	79.8	0.45	120	1	79 ±34	75 ± 11
NGC 7778	−5	23 50 46.6	+07 35 53	5238	13.40	20.46	16.5	0.12	65	1	198 ±10	... ± ...
NGC 7785	−5	23 52 45.5	+05 38 11	3848	12.44	20.77	20.4	0.42	139	1	253 ±22	86 ± 25

Notes:
column (2): morphological type (from the *LEDA* database - status: LEDA1996);
columns (3), (4): coordinates, from Prugniel & Simien (1997: hereafter PS97)
column (5): $v_{\rm hel}$, heliocentric radial velocity, in $\mathrm{km\,s^{-1}}$ (from *LEDA*);
column (6): $B_{\rm T}$, integrated blue magnitude, corrected for Galactic extinction and k term (from PS97);
column (7): $-M_B$, absolute B magnitude (for a distance modulus from PS97, corresponding to $H_0 = 75\,\mathrm{km\,s^{-1}\,Mpc^{-1}}$);
column (8): $r_{\rm e}$, effective radius, in arcsec (from PS97);
column (9): ϵ, ellipticity;
column (10): PA, position angle of major axis, in degrees (North through East, 0 to 180°);
column (11): reference for ϵ and PA, 1 = Djorgovski (1985), 2 = Michard (1985), 3 = Michard & Marchal (1993), 4 = *LEDA*;
column (12): σ_0, central velocity dispersion available in the literature, in $\mathrm{km\,s^{-1}}$; from an updated version of the compilation in Prugniel & Simien (1996: hereafter PS96) – excluding all previous measurements by ourselves;
column (13): $V_{\rm max}$, maximum rotation velocity available in the literature, in $\mathrm{km\,s^{-1}}$, from PS96 (same remarks as for σ_0).

4. Presentation of the results

Determinations of the heliocentric radial velocity $v_{\rm hel}$, of σ_0, and of $V_{\rm max}$ (together with the corresponding radius $r_{\rm max}$) are listed in Table 3. The $V(r)$ and $\sigma(r)$ profiles are presented in Fig. 1, and also in Table 4, which is proposed in electronic form only. Beginning with the present paper, we adopt for the position angle PA the following convention: for $0 < \mathrm{PA} < 180°$, $r < 0$ corresponds to the eastern side of the galaxy, for $180 < \mathrm{PA} < 360°$, $r < 0$ corresponds to the western side; and for $\mathrm{PA} = 0°$, $r < 0$ is to the North. Tables 1 through 4 are available from the CDS.

Our results are summarized as follows:

- We have measured the central velocity dispersion σ_0 for 24 E and S0 galaxies.
- For 21 galaxies in our sample, we have been able to determine the $\sigma(r)$ and $V(r)$ profiles along the major axis and, for five of them, along the minor axis as well. For 12 of these objects, the profiles extend beyond the effective radius. Whenever possible (for 17 galaxies), we have determined the maximum rotation velocity $V_{\rm max}$: this parameter was still unavailable for six of these objects.
- For a few galaxies, we note secondary peaks in the velocity dispersion, which are likely the result of a strongly non-gaussian LOSVD (line-of-sight velocity distribution); the most striking example is NGC 2768.

Table 3. Kinematical results

Object	$v_{\rm hel}$	σ_0	$V_{\rm max}$	$r_{\rm max}$
(1)	(2)	(3)	(4)	(5)
N0499	4321 ± 21	284 ± 21	31 ± 25	12
N0584	1816 ± 15	185 ± 12	147 ± 16	25
N0680	2884 ± 18	191 ± 15	112 ± 22	15
N0890	3952 ± 12	212 ± 15	$< 32 \pm ...$	20
N0990	3515 ± 17	156 ± 17	95 ± 32	10
N1016	6567 ± 31	286 ± 33	$... \pm ...$	...
N1023	592 ± 15	204 ± 07	205 ± 11	55
N1060	5113 ± 51	314 ± 46	$... \pm ...$	...
N1175	5523 ± 15	225 ± 14	221 ± 15	22
N1209	2600 ± 18	227 ± 19	211 ± 21	18
N1521	4163 ± 32	224 ± 24	73 ± 22	10
N1573	4207 ± 35	306 ± 38	$... \pm ...$	...
N1653	4343 ± 36	242 ± 19	91 ± 38	12
N1726	3995 ± 17	220 ± 26	$< 50 \pm ...$	20
N2314	3809 ± 31	271 ± 19	149 ± 25	15
N2340	5922 ± 28	260 ± 30	$< 32 \pm ...$	20
N2549	1039 ± 10	143 ± 10	160 ± 10	35
N2685	880 ± 10	92 ± 08	114 ± 14	35
N2732	1960 ± 07	149 ± 09	162 ± 18	31
N2768	1339 ± 13	176 ± 15	187 ± 28	72
N7332	1172 ± 05	131 ± 06	147 ± 12	38
N7457	812 ± 06	73 ± 10	70 ± 14	22
N7778	5278 ± 27	234 ± 26	$< 30 \pm ...$	15
N7785	3871 ± 19	239 ± 19	146 ± 24	22

Notes:
column (2): $v_{\rm hel}$, heliocentric radial velocity, in $\mathrm{km\,s^{-1}}$;
column (3): σ_0, central velocity dispersion, in $\mathrm{km\,s^{-1}}$;
column (4): $V_{\rm max}$, maximum rotation velocity, in $\mathrm{km\,s^{-1}}$;
column (5): $r_{\rm max}$, the radius at which $V_{\rm max}$ has been measured, in arcsec.

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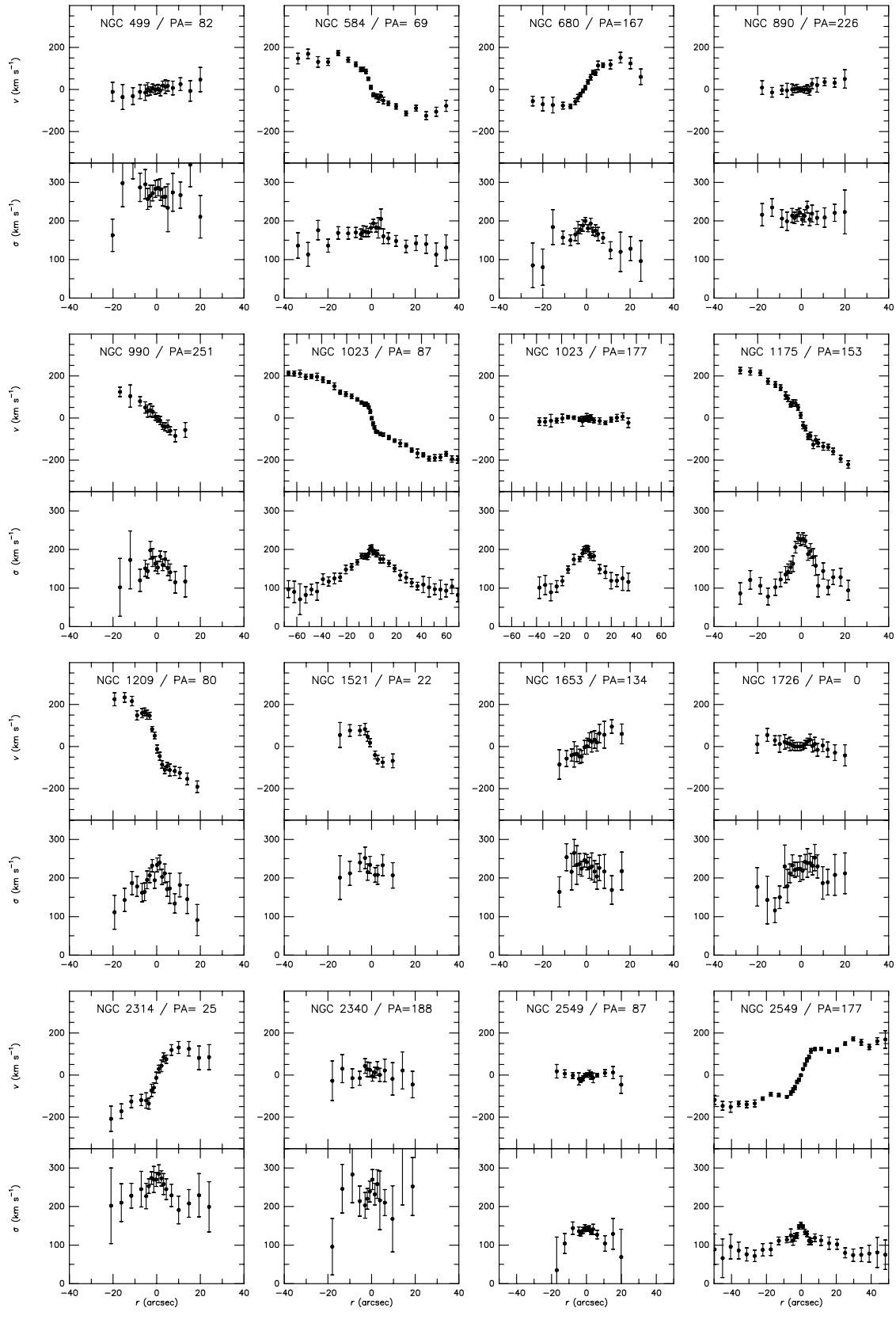

Fig. 1. Profiles of rotation velocities and velocity dispersions

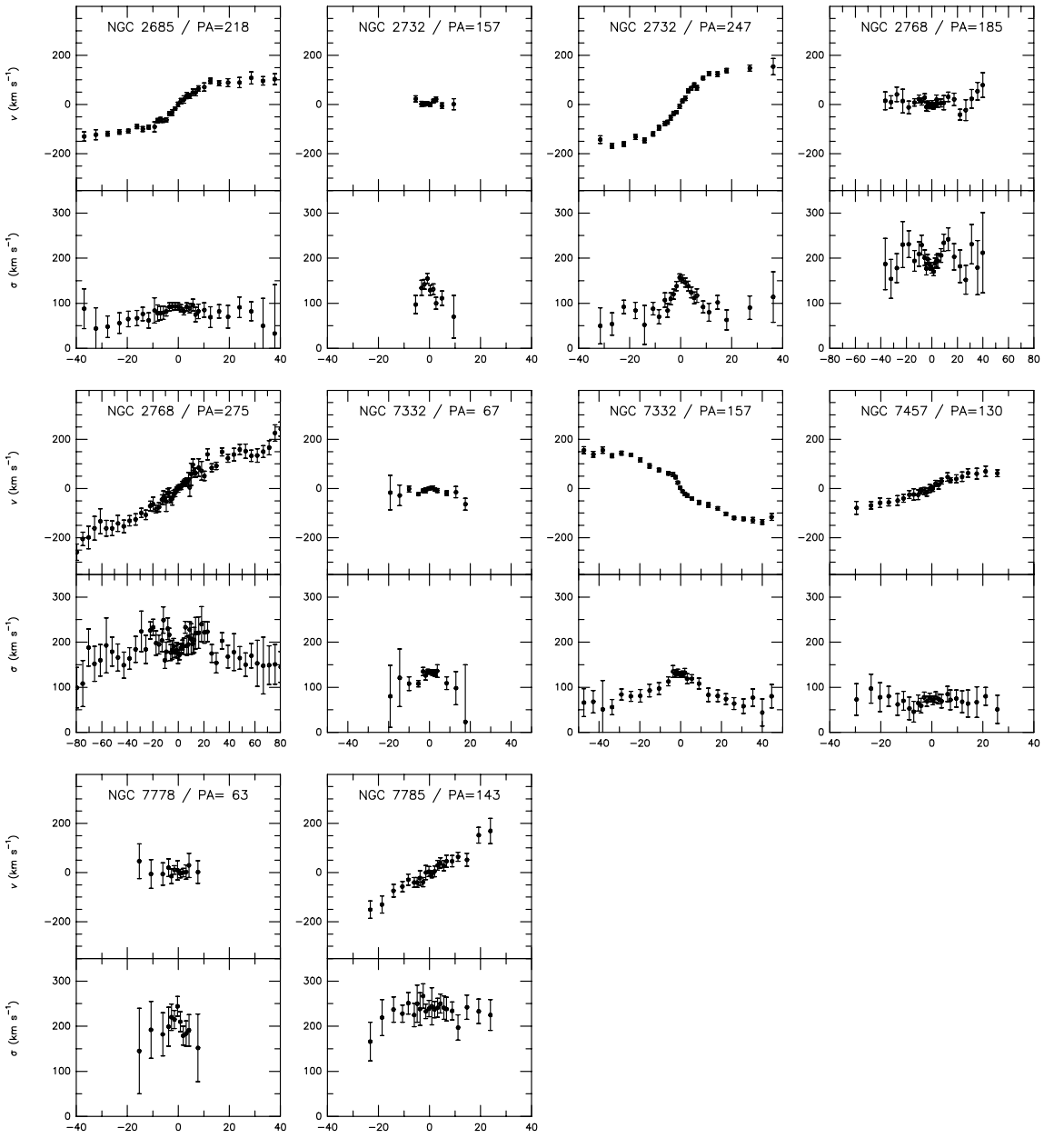

Fig. 1. continued