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ATLAS OF Hα EMISSION OF A SAMPLE OF NEARBY HICKSON COMPACT GROUPS OF GALAXIES

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ABSTRACT

Hα and adjacent continuum images are presented for a sample of nearby groups of galaxies extracted from the Atlas of Compact Groups of Galaxies. Also, more detailed Hα maps of the most remarkable galaxies are shown in this paper. A short description of the Hα emission for each of the galaxies with accordant redshift is presented together with a morphological classification of the accordant galaxies in the sample. A large fraction of ellipticals and lenticulars were detected in Hα. Also, clear signs of interactions were found in seven of the groups, but in only in three of them was Hα emission detected along the tidal features. Candidates of dwarf galaxies were found at the tips of the tidal tails developed during the interactions in these three groups.

Subject headings: atlases — galaxies: clusters: general — galaxies: ISM — galaxies: structure

1. INTRODUCTION

Compact groups of galaxies are dense aggregates containing between three and seven galaxies in which interactions between galaxies are supposed to be frequent because of their high spatial densities and their low velocity dispersions. It is well known that direct interactions between galaxies tend to increase their star formation rate (SFR) (Larson & Tinsley 1978; Bushouse 1987; Kennicutt et al. 1987), so, if interactions in compact groups are as common as expected, a global enhancement in the SFR of the galaxies should be detected. Although since the seminal work of Hickson (1982, 1993) much effort has been devoted to obtain broadband photometry of the galaxies in the groups (Zepf, Whitmore, & Levison 1991; Moles et al. 1994; Pildis, Bregman, & Schombert 1995) in order to study environmental factors on the SFR and the merging rate of galaxies in compact groups, until today there has been no information available on the Hα emission of the groups. Thus, given that the Hα emission has been proved to be a good indicator of the SFR of galaxies, we have performed an exhaustive study on the Hα emission of a sample of nearby groups from the compilation by Hickson (1982). In a forthcoming paper, an analysis of the SFRs of the galaxies in our sample compared to a sample of field galaxies will be performed.

We present in this paper an atlas of the Hα emission of a sample of nearby galaxies in compact groups. This is part of a series of papers concerning the global properties of star formation of galaxies in compact groups. The sample of groups chosen is described in § 2. The collection and reduction of the data, as well as the image processing, are described in § 3. A description of the most relevant morphological features of the galaxies is contained in § 4. Finally, in § 5 we discuss some statistical properties of the Hα morphology of the galaxies.

2. THE SAMPLE OF GROUPS

The sample of groups has been chosen from the Atlas of Compact Groups of Galaxies (Hickson 1993) in the way that (almost) all the groups in the Northern Hemisphere with $z < 0.02$ are observed except for HCG 10 and HCG 59. The sample was completed with some groups in the Southern Hemisphere also with $z < 0.02$, and with some groups of the Northern Hemisphere with $z > 0.02$. The relative fractions of galaxies according to their morphological types are as follows:

Ellipticals: 13%
S0–S0a: 16%
Sa–Sd: 49%
Later: 23%.

As will be mentioned later, some of the galaxies in our groups present discordant redshifts, i.e., their radial velocities are more than 1000 km s^{-1} higher or lower than the median value of the group. These galaxies are supposed to be foreground or background galaxies not physically associated to the group. For the subsequent analysis, we are just referring to the accordant galaxies of our sample of groups.

3. OBSERVATIONS AND DATA REDUCTION

Four telescopes were used in order to obtain all the data presented in this paper: The INT 2.5 m and JKT 1.0 m in the Observatorio del Roque de los Muchachos, the IAC80 in the Observatorio del Teide, and the 2.2 m telescope in the Observatorio Hispano-Alemán de Calar Alto. Also, some *R*-band images that were used as Hα continuum frames taken at the CFHT 3.6 m were kindly made available to us by Paul Hickson. A complete log of the observations is presented in Table 1.

The images taken at the INT were obtained during an observational run in 1994 November except for HCG 95. This group was observed during one service night in 1995 September. The INT was used in the prime focus configuration. We used a 1024 × 1024 Tektronik chip with a scale of 0".57 $pixel^{-1}$. The total field size was 9'.22 in each spatial direction. The JKT 1.0 m was used in 1997 April in the imaging configuration with a 1024 × 1024 Tektronik chip. The pixel scale on the sky was 0".33, which gives a total field size of 5'.66 in each spatial direction.

Johnson *R*-band images for two galaxies were obtained at the IAC80. The detector used is a 1024 × 1024 Tektronik chip with angular scale 0".435 per $pixel^{-1}$. The total field size is 7'.3 in each spatial direction.

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TABLE 1
LOG OF OBSERVATIONS

Group (1)	Date (2)	Telescope (3)	Filter (4)	Exposure Time (5)
HCG 2	1994 Nov	INT 2.5 m	6655(45)	3 × 1200
			6565(60)	3 × 700
HCG 7	1994 Nov	INT 2.5 m	6655(45)	3 × 1200
			6565(60)	3 × 800
HCG 16	1994 Nov	INT 2.5 m	6655(45)	3 × 800
			6565(60)	3 × 700
HCG 23	1994 Nov	INT 2.5 m	6655(45)	3 × 1200
			6565(60)	3 × 700
HCG 30	1994 Nov	INT 2.5 m	6655(45)	3 × 1000
			6565(60)	3 × 800
HCG 31	1994 Nov	INT 2.5 m	6655(45)	3 × 600
			6565(60)	3 × 500
HCG 37	1994 Nov	INT 2.5 m	6715(45)	3 × 500
			6565(60)	3 × 800
HCG 44	1995 Apr	INT 2.5 m	6607(50)	500, 300
	1997 Apr	JKT 1.0 m	6590(50)	1200,1800
	1984 Dec	CFHT 3.6 m[a]	Johnson *R*	200
	1997 May	IAC80	Johnson *R*	500
HCG 54	1995 Apr	INT 2.5 m	6607(50)	2 × 1200
	1984 Jun	CFHT 3.6 m[a]	Johnson *R*	200
HCG 61	1995 Apr	INT 2.5 m	6607(50)	1200
			6300(54)	2 × 1000
HCG 68	1995 Apr	INT 2.5 m	6607(50)	2 × 500
			6300(54)	2 × 500
HCG 79	1995 Apr	INT 2.5 m	6655(45)	2 × 1200
			6300(54)	2 × 1000
HCG 92	1996 Aug	2.2 m	6650(80)	1000
			6740(70)	1000
			6569(113)	1000
HCG 93	1996 Aug	2.2m	6650(80)	1200
			6569(113)	1200
HCG 95	1995 Sep	INT 2.5 m	6832(50)	3 × 1000
			6742(50)	3 × 1000
HCG 100......	1996 Aug	2.2m	6650(80)	1400
		CFHT 3.6 m[a]	Johnson *R*	200

NOTES.—Col. (1): Identifier of the group. Col. (2): Date of observation. Col. (3): Telescope. Col. (4): Central wavelength of the filter in Å. The number in parentheses indicates the FWHM of the filter in Å. Col. (5): Exposure times in seconds.

[a] Courtesy P. Hickson.

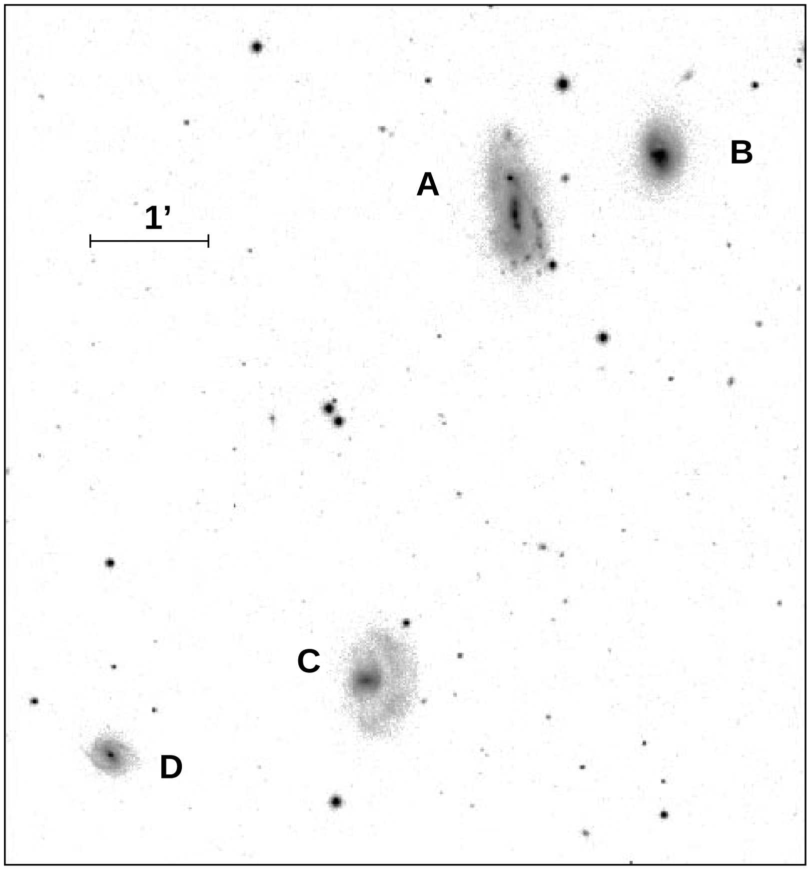
The 2.2 m telescope was used with the focal reducer CAFOS in the imaging configuration. We used a 2048 × 2048 SITE chip. The pixel scale was 0″.54 with a total field size of 16′. However, owing to the size of the filters used, the outer parts of the frames were vignetted, and thus only a circular surface of about 11′ diameter was available.

Net Hα frames were constructed in two different ways: For those groups with continuum frames available, we scaled the continuum frame in such a way that the average fluxes of the field stars were equal in both frames. Given that for some of the groups no continuum frames were available, we used *R* frames instead. In order to scale the *R* frames with the Hα frames, we measured the flux of several field stars in both frames and multiplied the *R* frame by the average value of the ratio between the flux of the stars in the Hα frame and in the *R* frame. If the average value was good enough, i.e., standard deviation less than 5% of the average value, we considered the scaled *R* frame as a good continuum frame. Otherwise, we scaled the images in such a way that the outer parts of the early-type galaxies presented almost the same intensity level in both frames. This criterion is justified if we assume that the Hα emission of early-type galaxies is concentred toward the center, as has been reported by some authors (Macchetto et al. 1996). For those galaxies with strong Hα emission, the contribution of the Hα line to the integrated *R*-band light is nonnegligible. In order to correct for this effect we multiplied the *R* band frame by $(1 - \mathrm{EW}_\alpha/\mathrm{EW}_R)$, where EW_α is the Hα equivalent width map and EW_R is the full width at half-maximum of the *R* filter. In this way, the *R*-band frame is corrected from the effect of the presence of a strong Hα line, and thus we get a better continuum frame.

4. DESCRIPTION OF THE GROUPS

Figures 1–16 show continuum and net Hα maps of the groups of our sample. In the net Hα frames, the residue of the field stars due to the subtraction of the continuum frames has been removed for clarity. Also, we have masked the net Hα frames in order to remove the noise of the sky. The Hα frames corresponding to those groups for which more than one Hα filter was used owing to the differences in the radial velocities of the galaxies are mosaics of the Hα original frames taken of each one with the corresponding filter. Also, owing to the large angular size of the group, the Hα frame corresponding to HCG 44 was composed as a mosaic of four different images taken at different telescopes.

HCG 2.—Although this group is composed of four galaxies, only galaxies A, B, and C have accordant redshifts, so it could be just a bounded triplet. Galaxy A is a late-type barred spiral with Hα emission along the bar and outward.



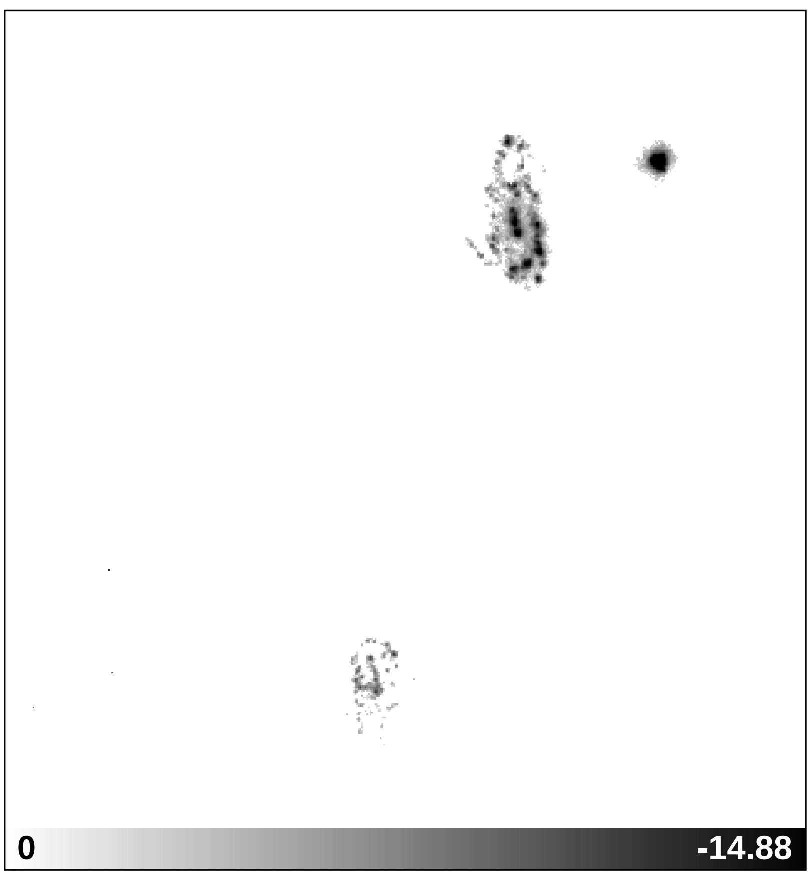


FIG. 1.—Continuum (*upper*) and Hα (*lower*) frames of HCG 2. In both frames north is up, and east is to the left. Gray scale is logarithmic. The upper limit in the gray scale indicates the log of the Hα flux in ergs s^{-1} cm^{-2}.

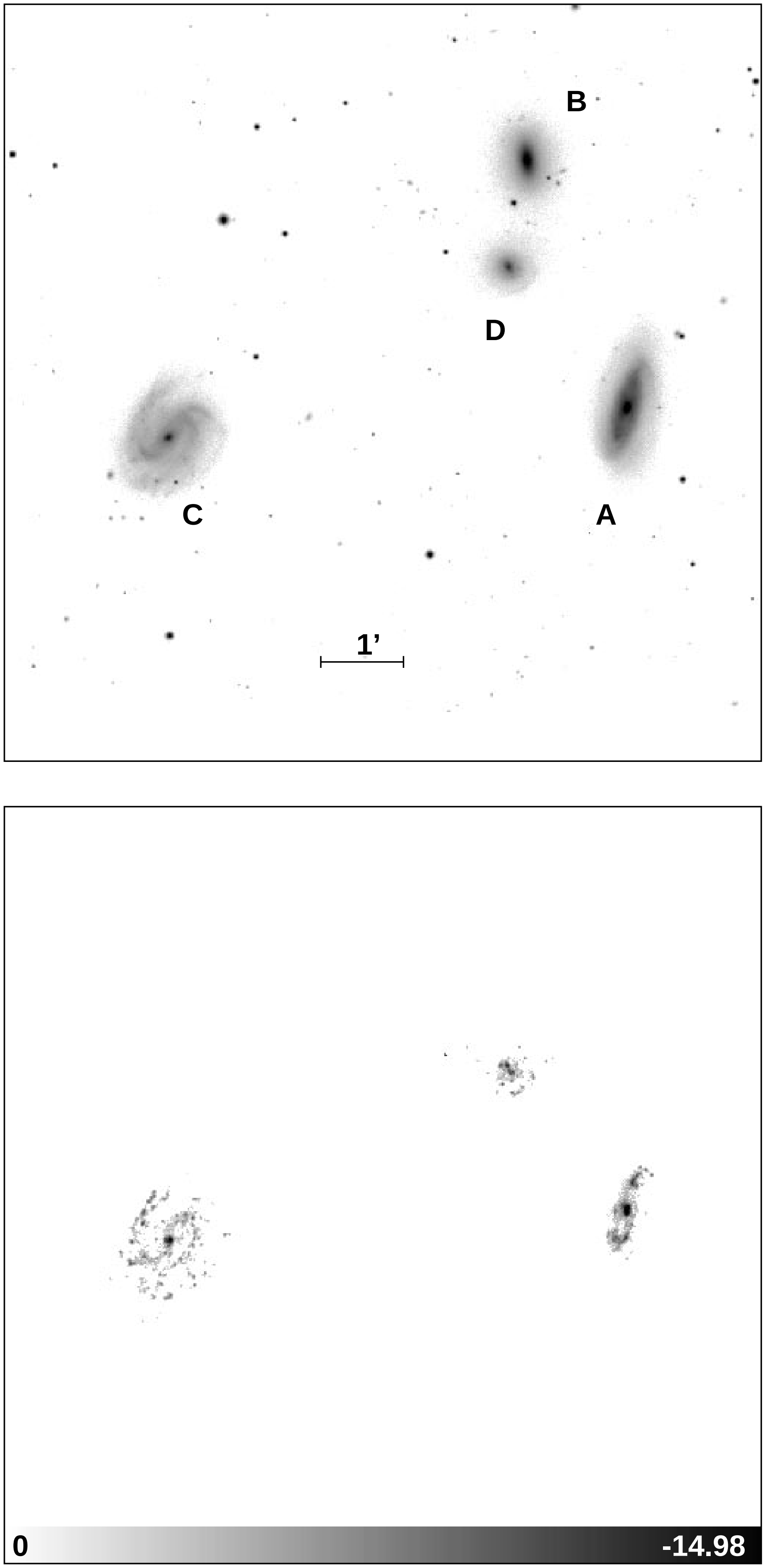


FIG. 2.—Same as Fig. 1 for HCG 7

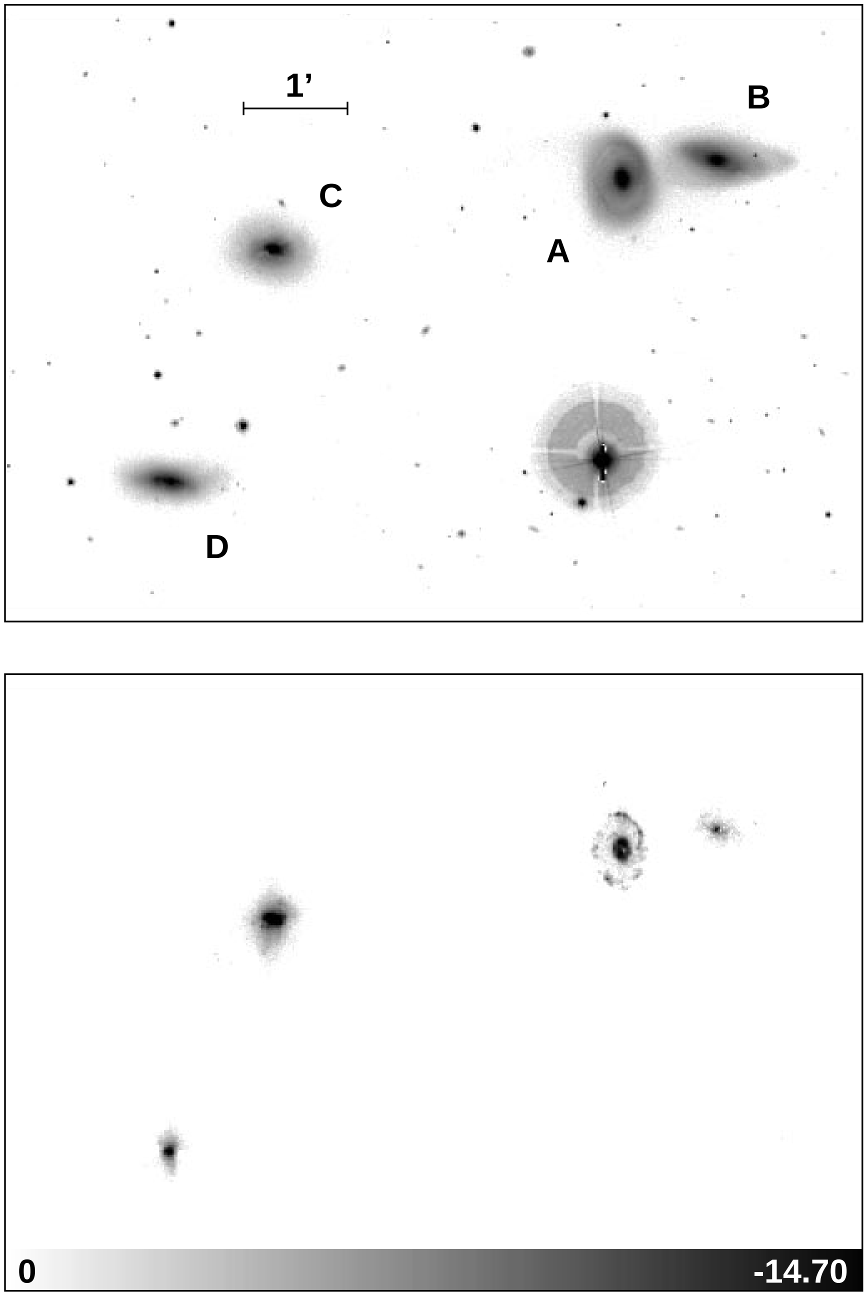


FIG. 3.—Same as Fig. 1 for HCG 16

Several bright knots are resolved throughout its disk. Arms are almost not apparent in this galaxy. Figure 17 shows a zoomed Hα map of this galaxy. Galaxy B is a compact irregular that shows a central knot in Hα. The outer parts of this galaxy do not show Hα emission although they were detected in the continuum frame. Galaxy C was also cataloged as a barred galaxy, but no signs of the presence of a bar are really apparent either in the continuum nor in the Hα frames. It seems to be almost edge-on, and a dust lane is detected in the continuum frame. Several faint Hα knots were resolved centered toward the nucleus of this galaxy. The angular diameter of the group is 7.′1.

HCG 7.—This group is composed of four galaxies with accordant redshifts. Galaxy A is an early-type spiral with quite a regular morphology. It shows a bright knot of Hα emission in the nucleus and several fainter knots toward the arms. These knots are embedded in a low surface brightness background of Hα emission. Galaxy B is a barred lenticular with very little Hα emission detected at the 2 σ level. Galaxy C is a barred late-type spiral with two well-developed arms. This galaxy shows Hα knots in the nucleus and throughout the disk. Galaxy D is classified with the same type as the previous one. As it is fainter, its arms are not as apparent as for galaxy C. The Hα knots detected are located in the center and in the southern arm. The angular diameter of the group is 5.′7.

HCG 16.—The two brightest galaxies in this group are interacting and show quite a disrupted morphology. Galaxy A shows a tidal tail extending outward the disk in the continuum frame, but no counterpart for this feature was found in the net Hα frame. This galaxy shows circumnuclear emission around the inner nucleus. Also, it shows a sort of ring-

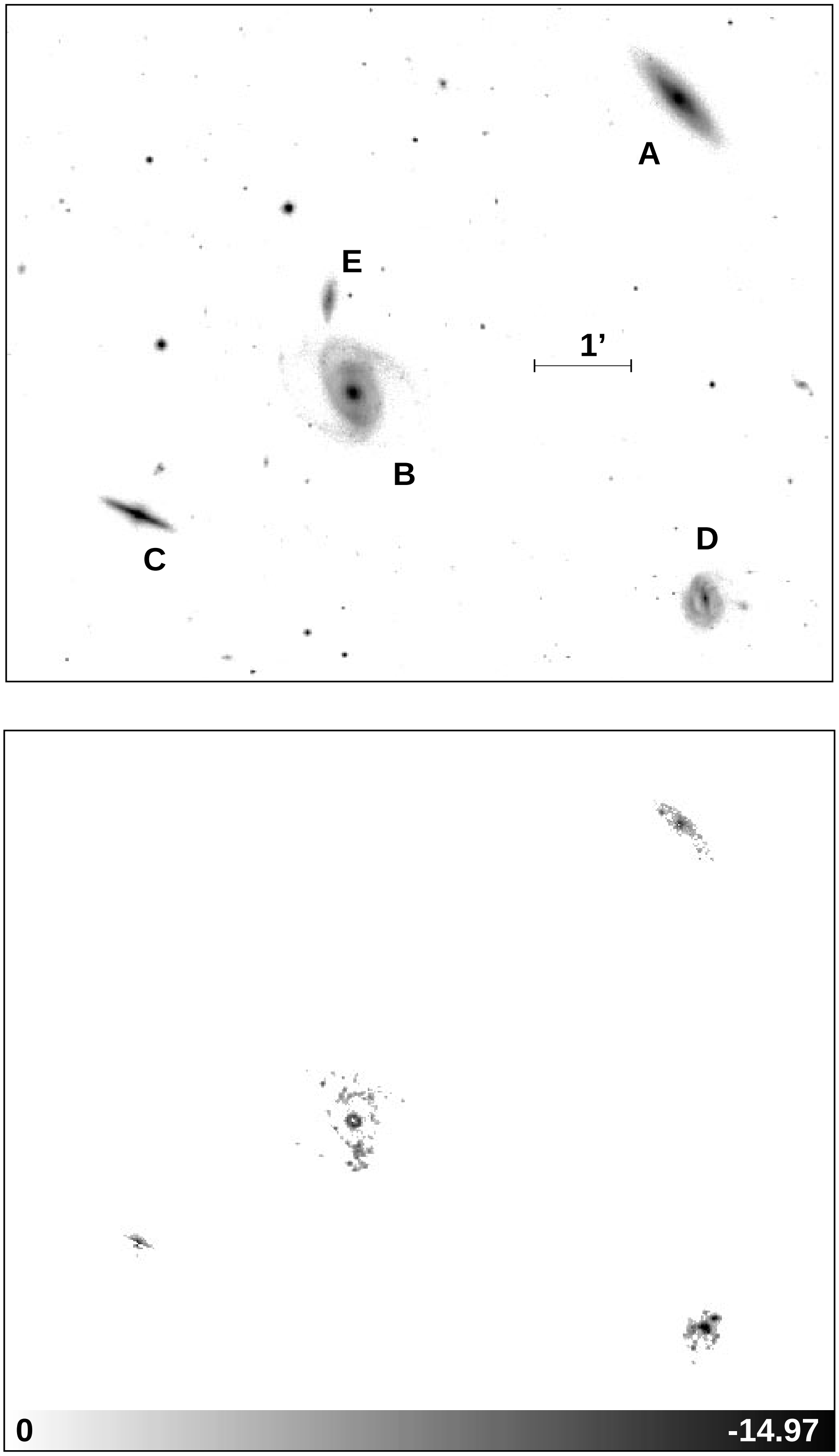


FIG. 4.—Same as Fig. 1 for HCG 23

like emission region in the outer disk with faint diffuse emission inside. This ringlike emission could be related to the interaction with galaxy B. A zoomed version of the Hα map of this galaxy is shown in Figure 18. Galaxy B is classified as an early-type spiral. Its morphology is quite distorted, but no tidal features are apparent either in the continuum nor in the Hα frames. It shows Hα emission concentrated in the inner nucleus with some faint emission surrounding it. Galaxy C is an irregular galaxy that shows a bright central region of Hα emission whose major axis is perpendicular to the major axis of the galaxy in the continuum frame. Galaxy D is of the same type as galaxy C, and also the Hα emission region and the continuum galaxy are perpendicular. These two galaxies, although classified as irregulars, are good examples of compact irregular galaxies because of their compact central Hα emission regions rather than being shared in fainter knots throughout the galaxies. The angular diameter of the group is 6$'$.4.

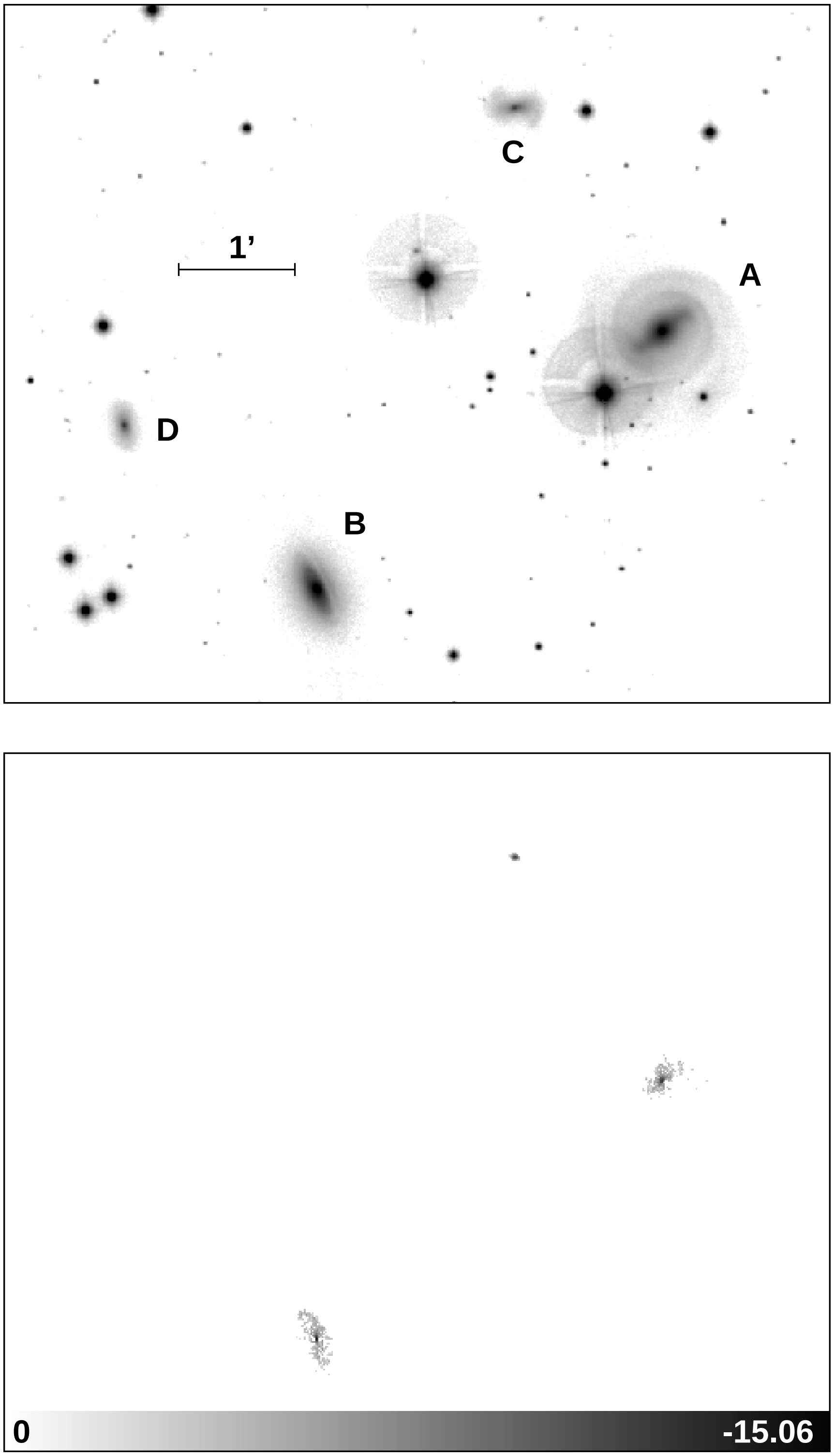


FIG. 5.—Same as Fig. 1 for HCG 30

HCG 23.—Only four of the five galaxies initially included in the group have accordant redshift. Galaxy A is an early-type spiral with Hα emission almost only in its center. Galaxy B is a late-type barred spiral with a strong ring of circumnuclear emission and several knots throughout the disk, even at the tips of the arms. Galaxy C is an almost edge-on lenticular with little Hα emission detected. The emission region is divided into two zones by the likely existence of a dust lane across the disk. Galaxy D is a late-type spiral that shows a bar in the continuum frame. However, the Hα map shows several knots distributed throughout the galaxy, the brightest of them being coincident with the nucleus. The angular diameter of the group is 7$'$.1.

HCG 30.—Little emission was detected in the four galaxies of this group. Galaxy A is a face-on barred early-type spiral with fairly large arms. Only a central region of Hα emission was detected. Unfortunately, this galaxy is very near a bright field star whose light contaminates the emis-

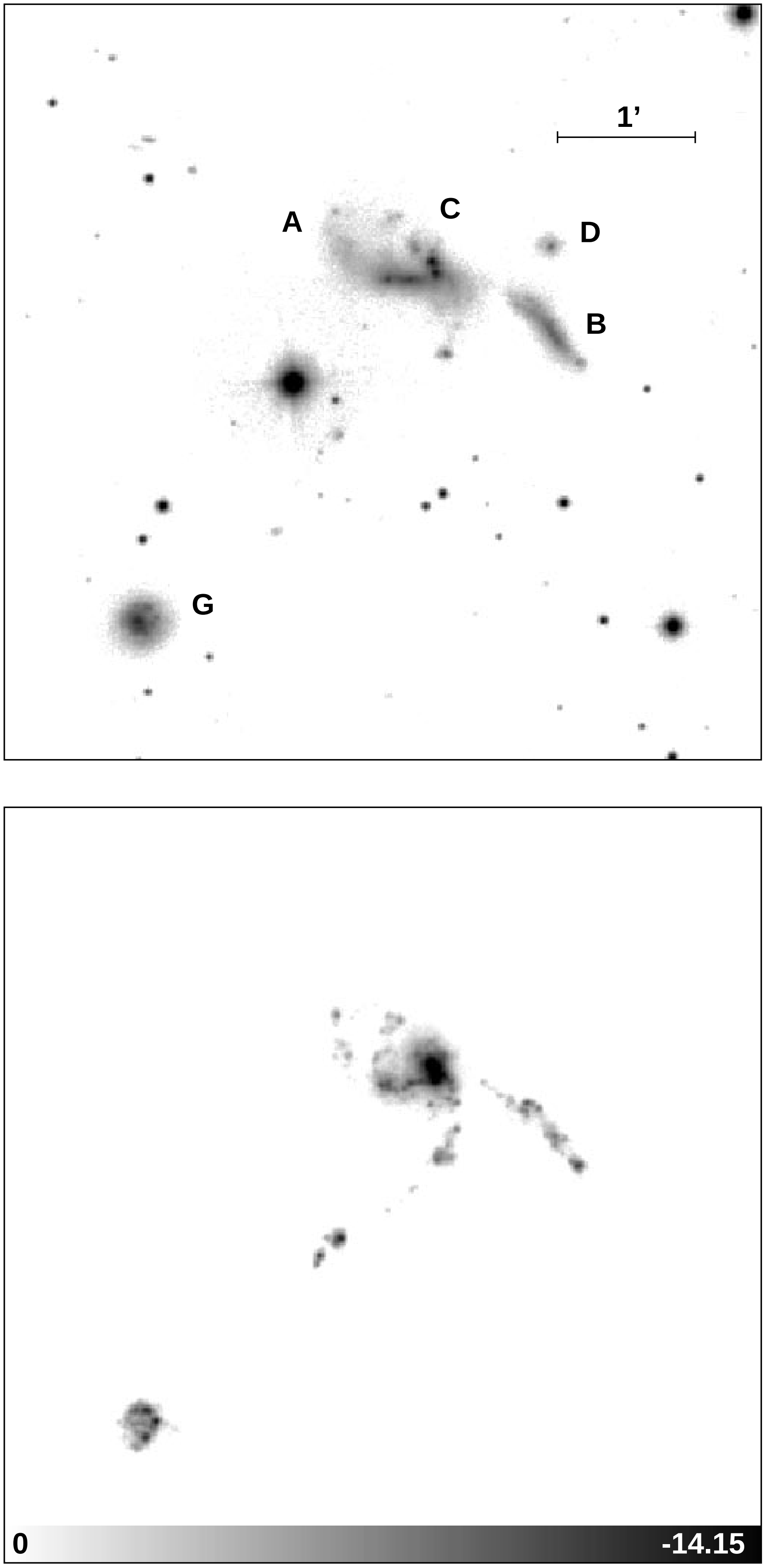


FIG. 6.—Same as Fig. 1 for HCG 31

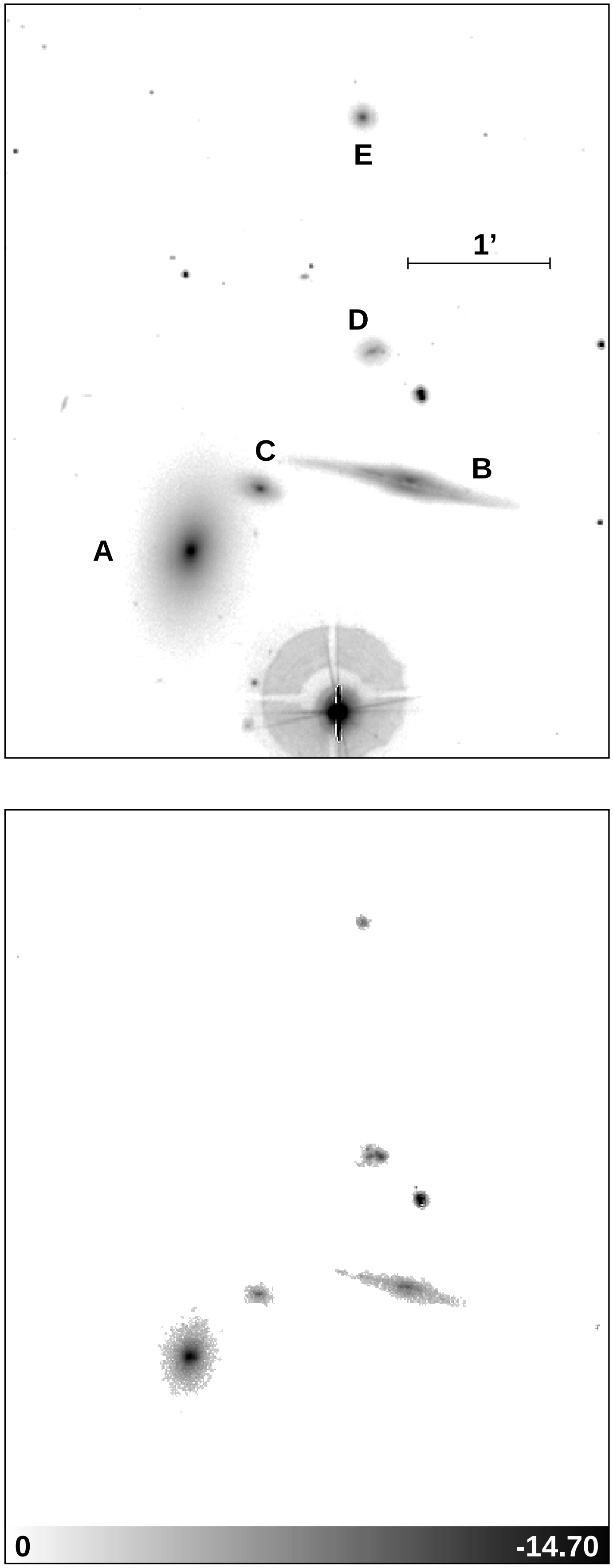


FIG. 7.—Same as Fig. 1 for HCG 37

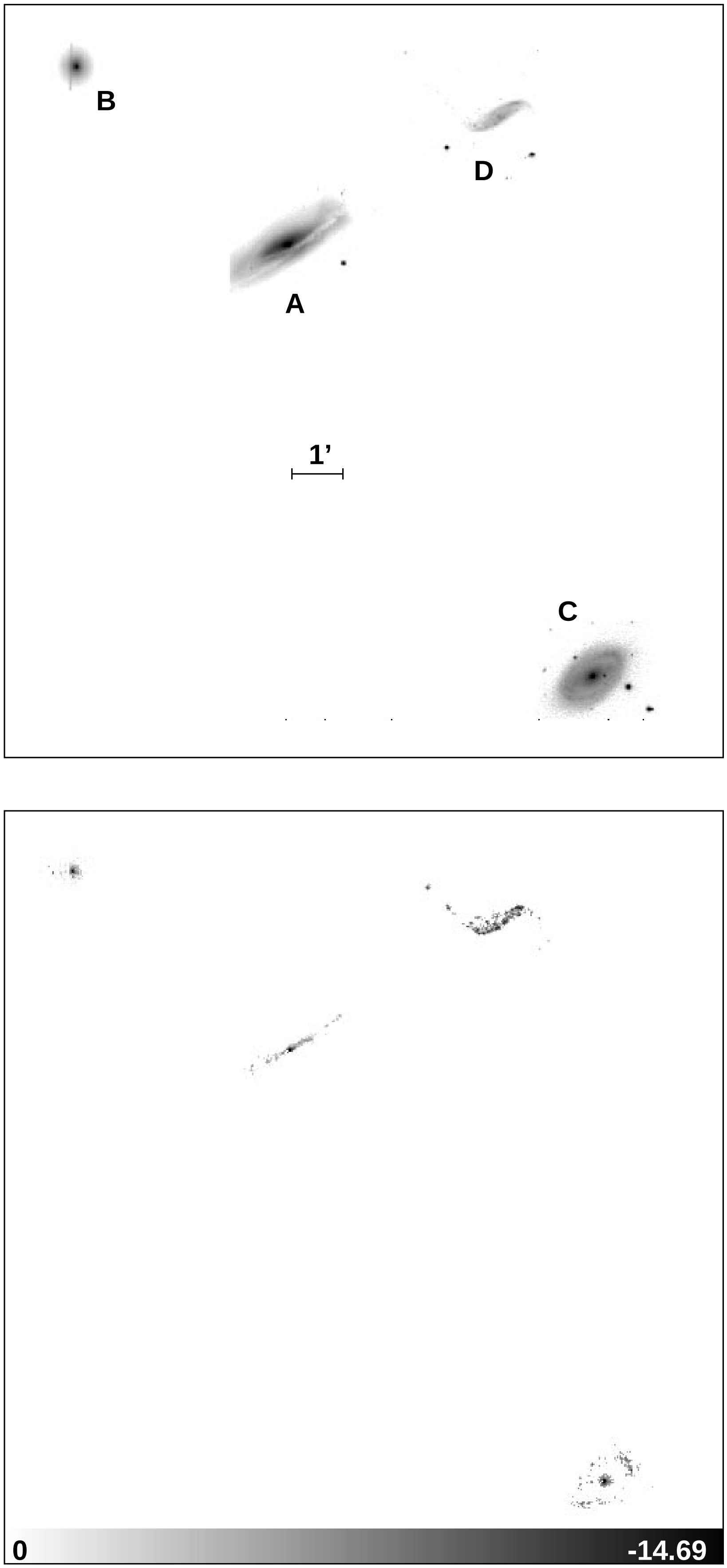


FIG. 8.—Same as Fig. 1 for HCG 44

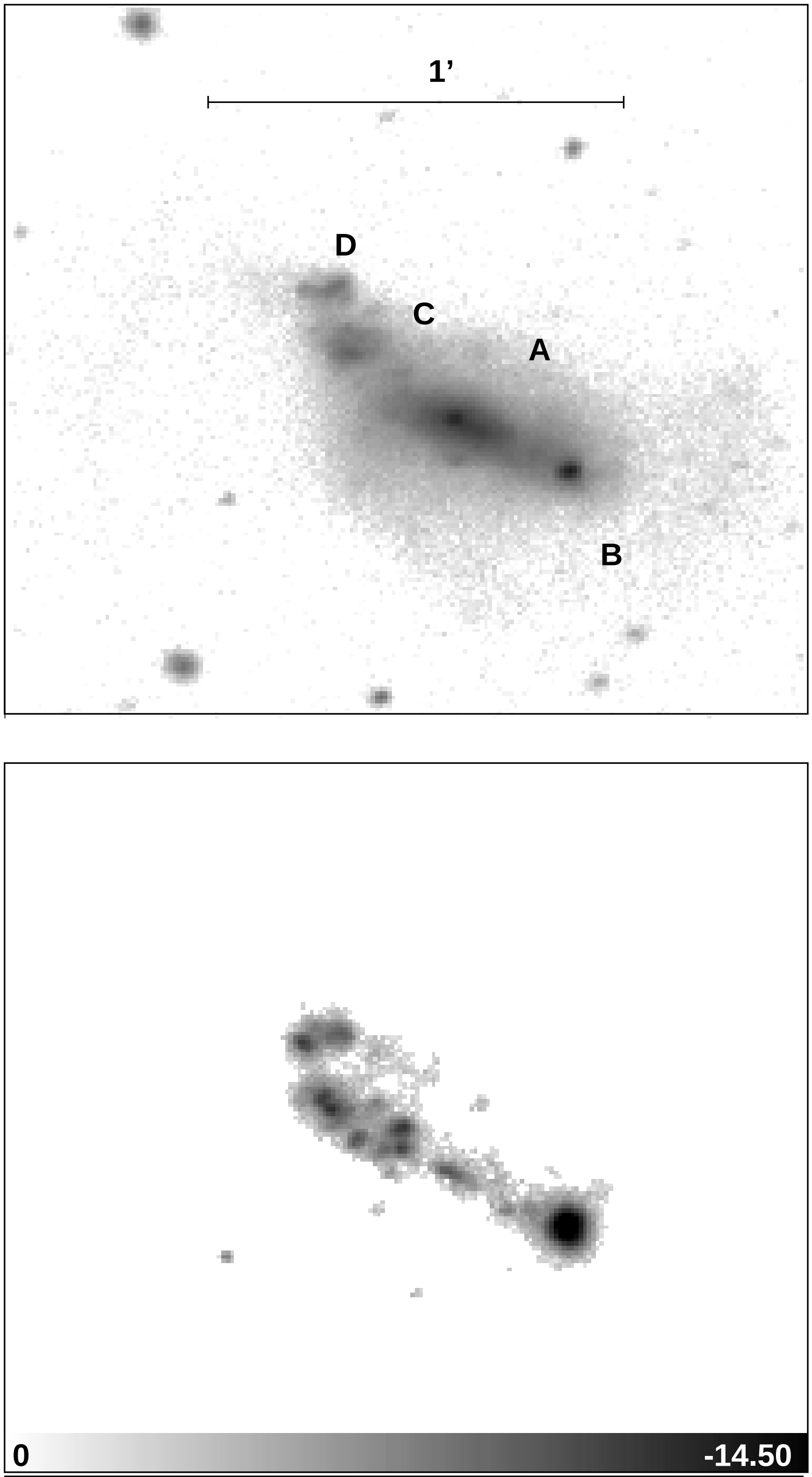


FIG. 9.—Same as Fig. 1 for HCG 54

sion coming from this galaxy. Because of this, larger errors may be affecting the Hα emission measured. Galaxy B is also an early-type spiral. A dust lane is apparent in the continuum frame. The Hα emission detected is concentrated throughout the bulge of this galaxy. Galaxy C is a barred late-type spiral with a peculiar morphology, resembling a butterfly. It shows a central knot of Hα emission. Galaxy D is a lenticular galaxy with no Hα emission detected at all. The angular diameter of the group is 4$'\!.$5.

HCG 31.—This interesting group has been widely discussed in the literature (Rubin, Hunter, & Ford 1990; Iglesias-Páramo & Vílchez 1997). It originally consisted of

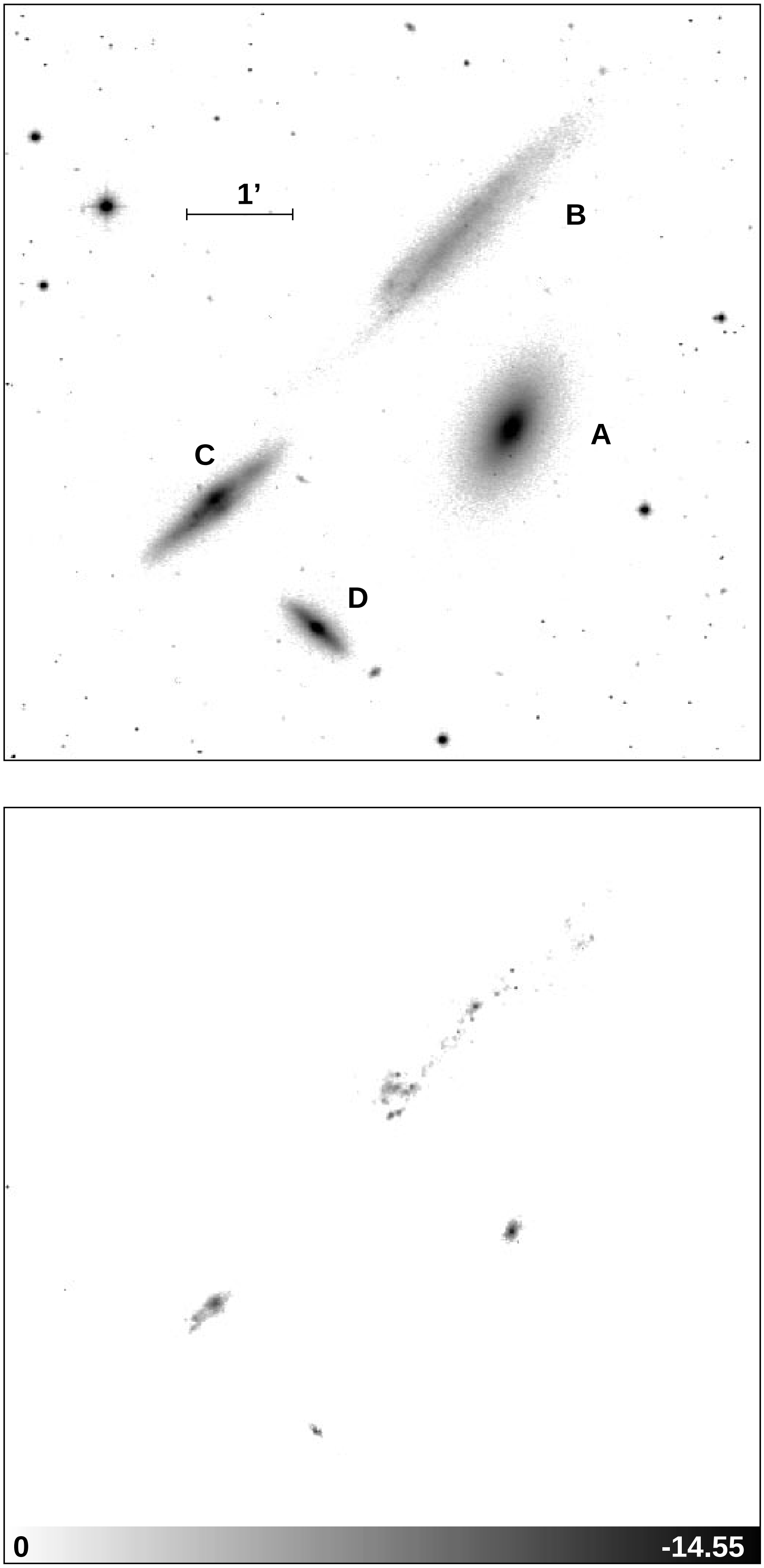


FIG. 10.—Same as Fig. 1 for HCG 61

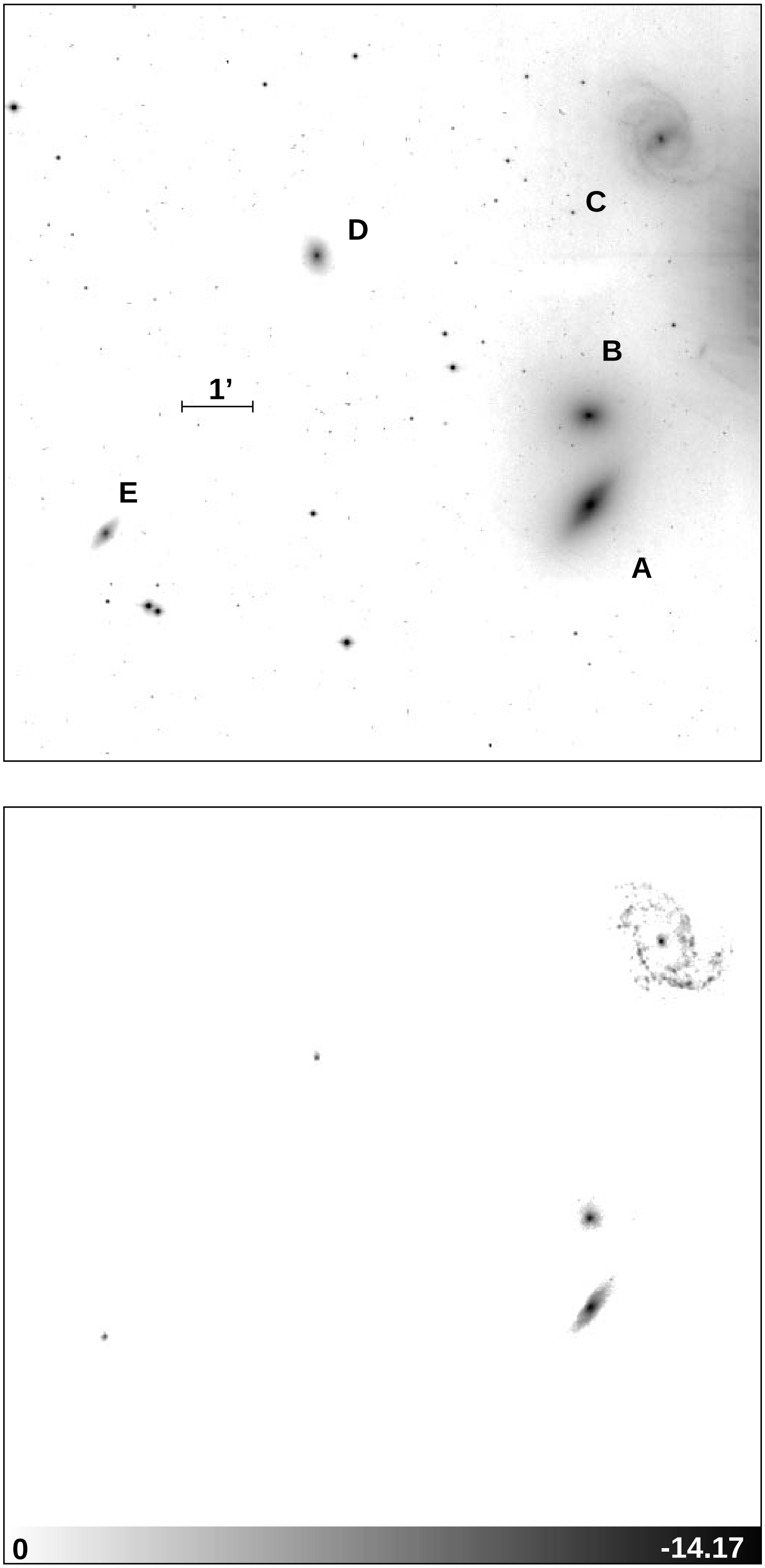


FIG. 11.—Same as Fig. 1 for HCG 68

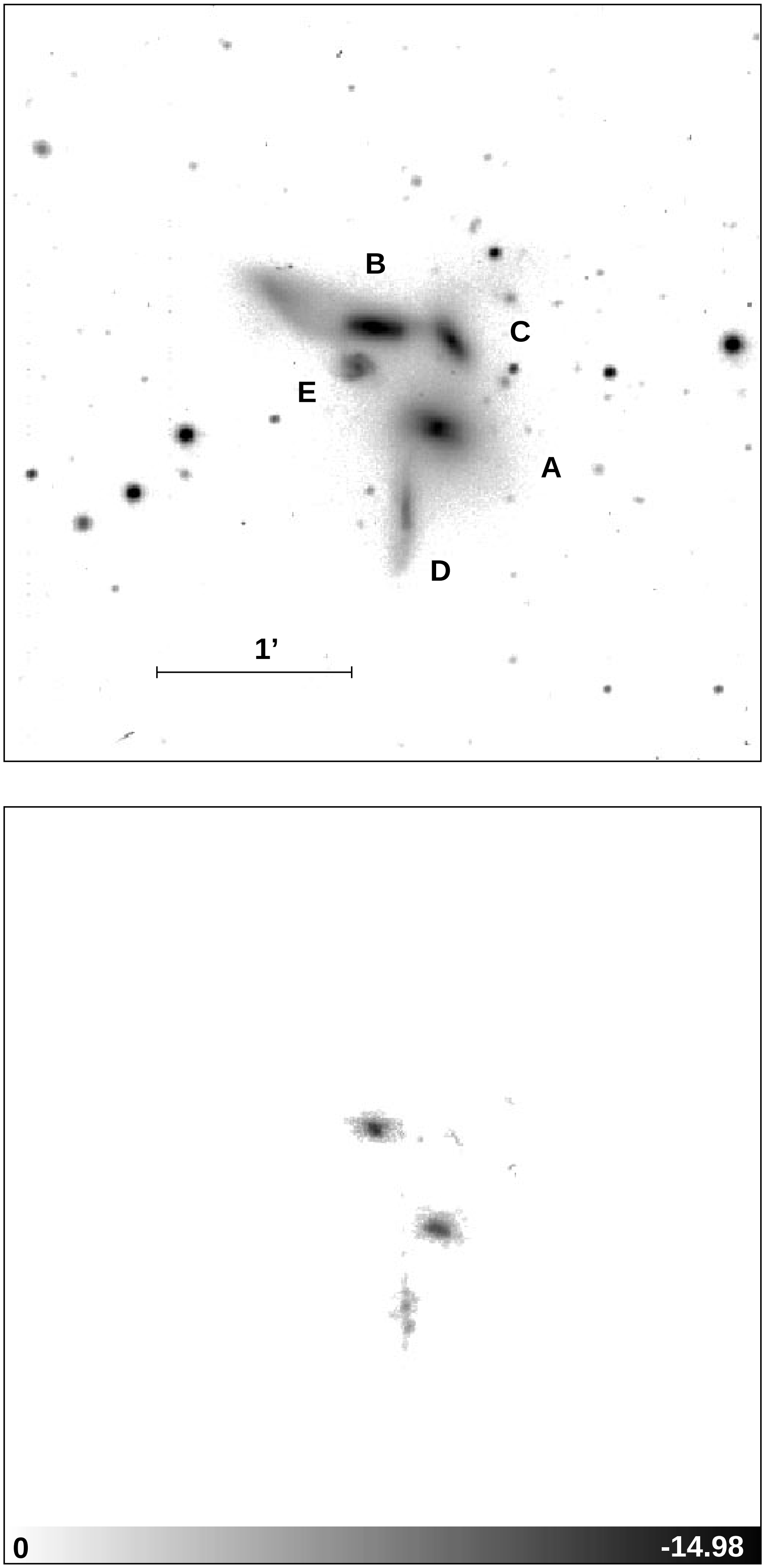


FIG. 12.—Same as Fig. 1 for HCG 79

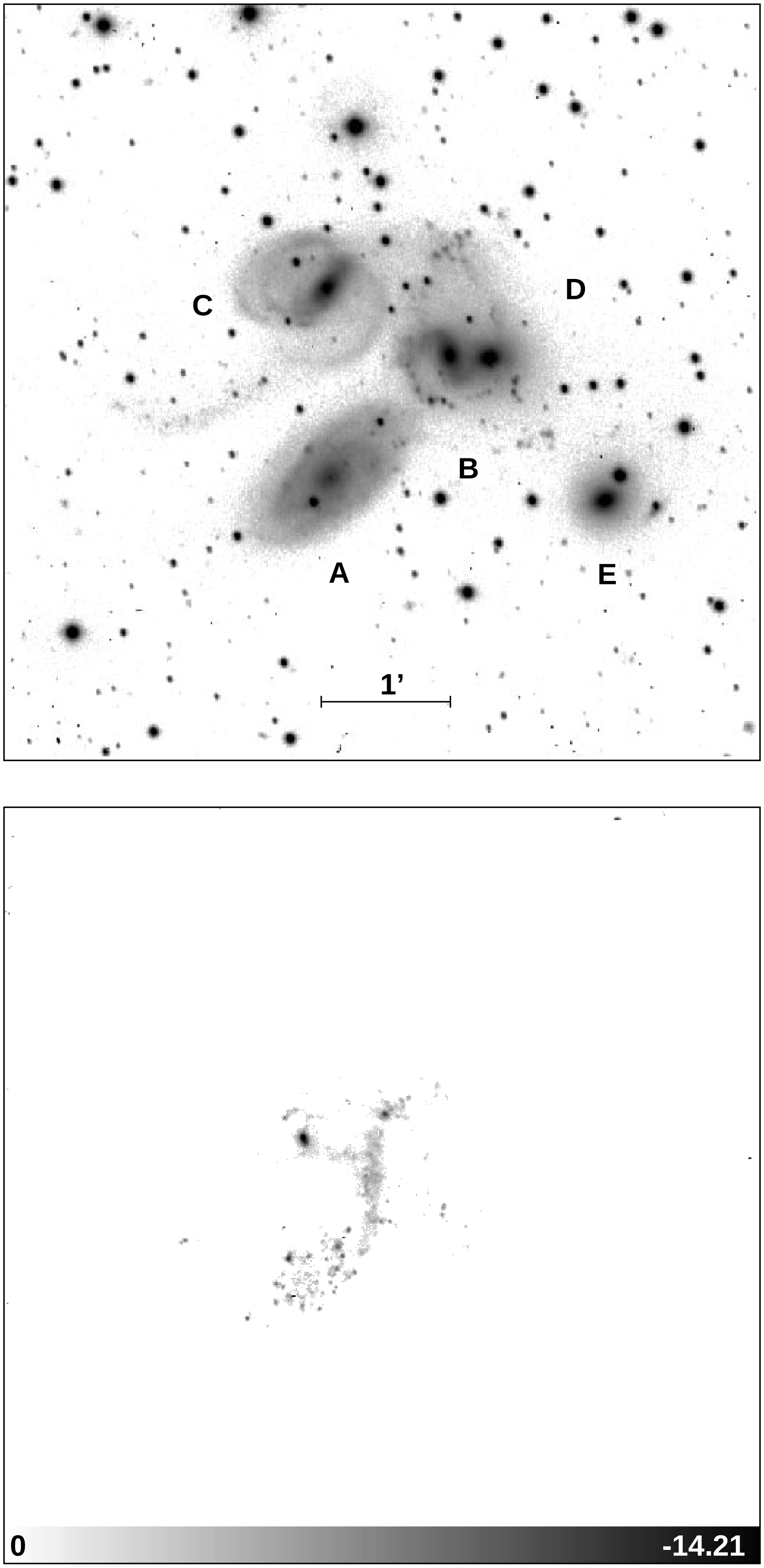


FIG. 13.—Same as Fig. 1 for HCG 92

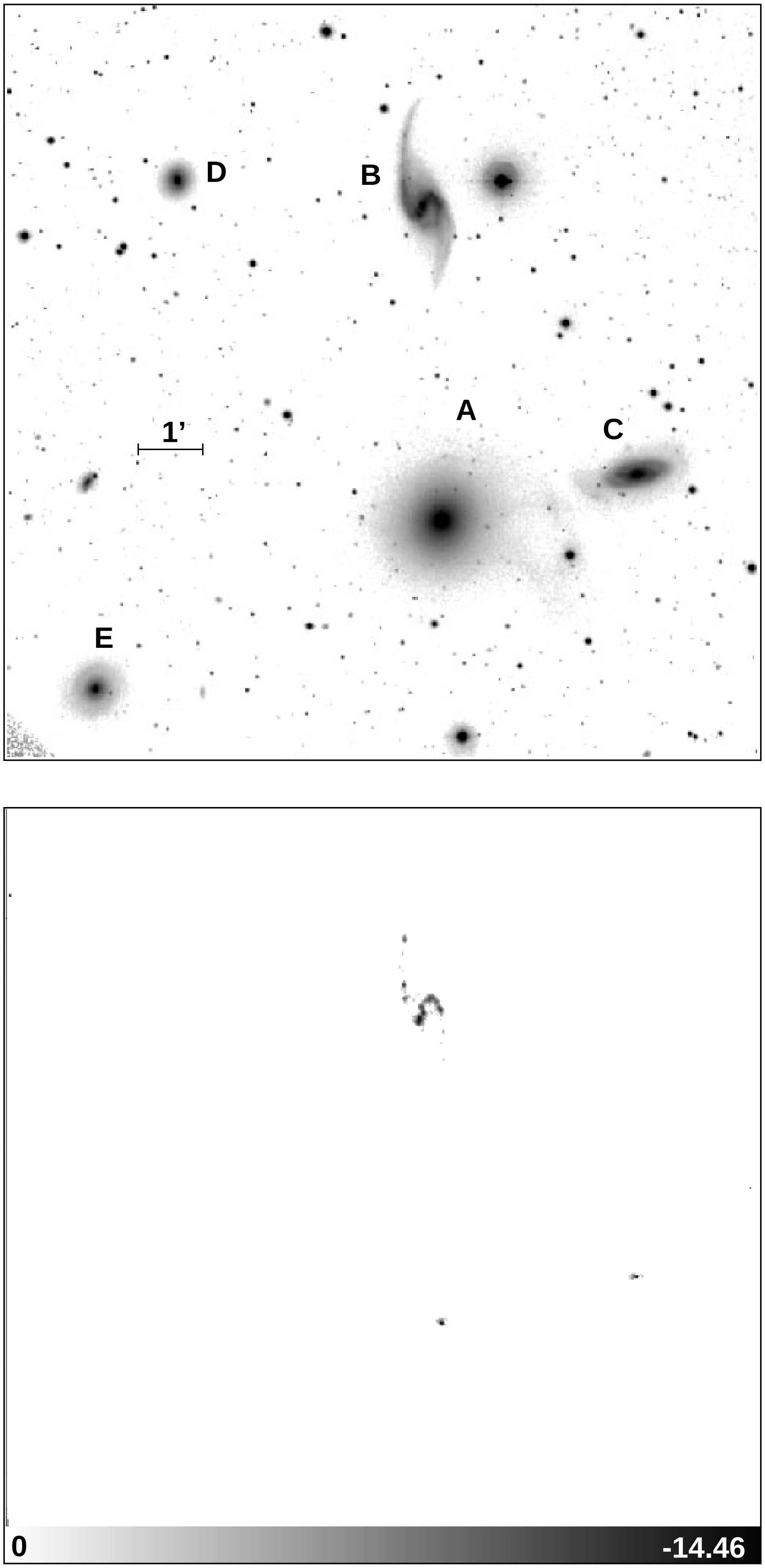


FIG. 14.—Same as Fig. 1 for HCG 93

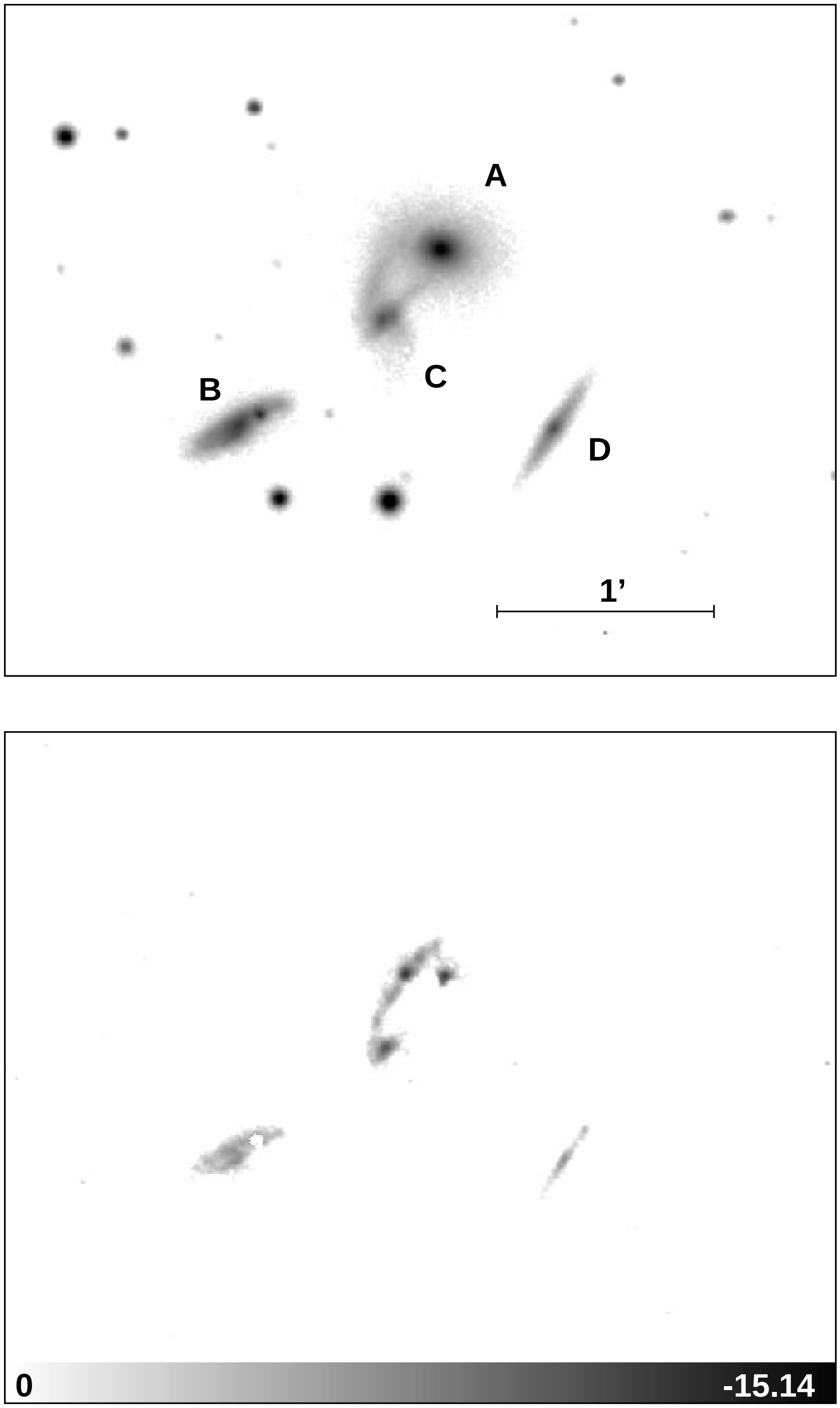


FIG. 15.—Same as Fig. 1 for HCG 95

four galaxies, three of which are interacting and are thought to merge in a short time. The remaining galaxy has a very discordant redshift. Galaxies A and C are thought to be an ongoing merger with two nuclei apparent in the continuum and the Hα frames. Related to these two galaxies are some Hα knots along the tidal tails developed during the interaction. Galaxy B shows three main bursts of Hα emission, one of them resolved in some smaller bursts. There is also a little chain of faint bursts linking galaxy B with the pair A and C. To the southeast there is another galaxy that was included as a member of the group (Rubin et al. 1990) and that shows an almost spherical shape in the continuum frame but with at least three bright circumnuclear knots overimposed on a faint background of Hα emission. The angular diameter of the original group, as reported by Hickson, is 0$'\!.$9. However, if we take into account the galaxies recently pointed out as being related to the group, the angular diameter is 4$'\!.$5.

HCG 37.—The five galaxies in this group show Hα emission, the brightest of which is a blue elliptical with a disk of

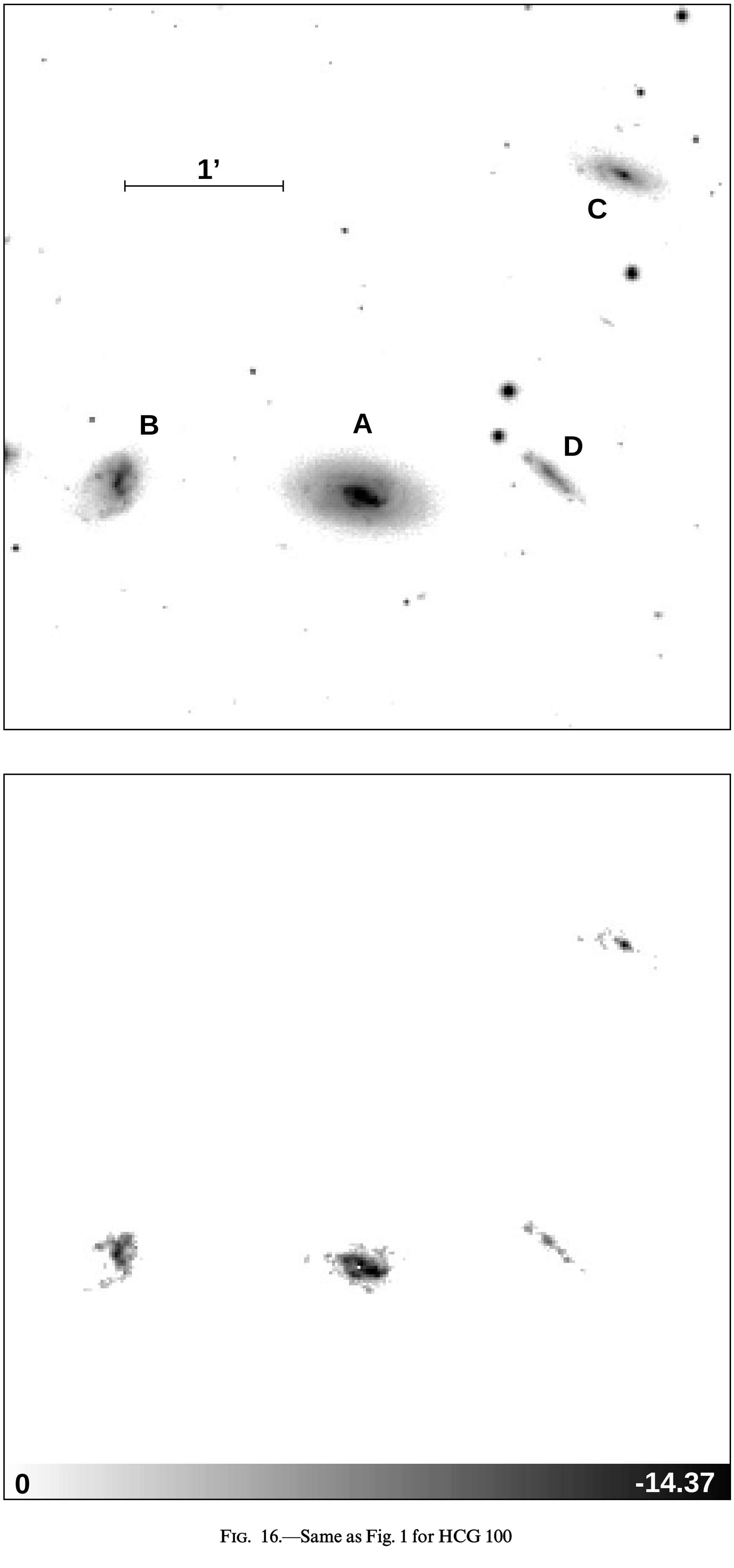


FIG. 16.—Same as Fig. 1 for HCG 100

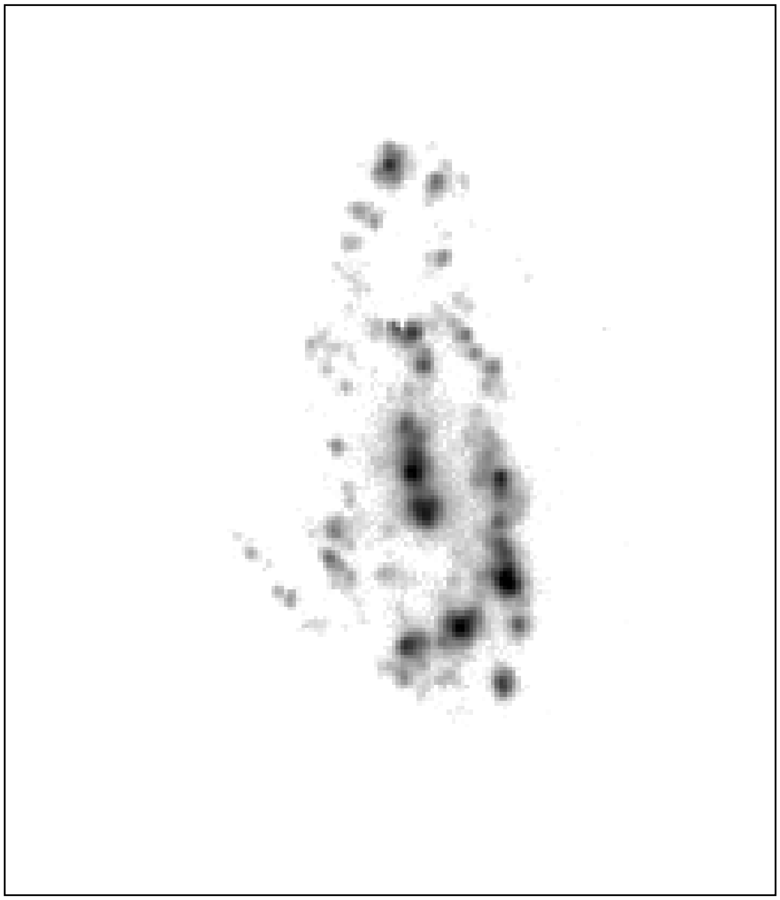


FIG. 17.—Enlarged detail of HCG 2a

ionized gas in the center (Rubin, Hunter, & Ford 1991). This galaxy is a good candidate for a merger remnant. Galaxy B is an edge-on spiral with faint emission detected. A dust lane across the disk is apparent in the continuum frame. Galaxy C is an early-type spiral that also shows faint Hα emission. The projected position of this galaxy coincides with the outer isophotes of galaxy A, and in a short time it could be accreted by this galaxy. Galaxy D is cataloged as a barred late-type spiral, but no signs of a bar are detected either in the continuum frame or in the Hα frame. This galaxy shows two resolved nuclei in Hα. Galaxy E is a dwarf elliptical that shows central Hα emission. The angular diameter of the group is 3′.2.

HCG 44.—This group is composed of four galaxies, two of which show a little disruption that may be due to an interaction. Galaxy A, an almost edge-on early-type spiral, shows nuclear emission and some fainter H II regions through the disk. It also shows a strong dust lane, and the outer isophotes seem to be distorted. Galaxy B is an elliptical with a central region of Hα emission. Only an upper limit for the Hα luminosity of this galaxy has been previously reported (Goudfrooij et al. 1994). Again, the net Hα image of this galaxy is contaminated by the light coming from a bright nearby star. Galaxy C shows a nuclear emission knot surrounded by a ring of H II regions with no Hα emission inside this ring. This galaxy has been reported to be a Seyfert 2. Galaxy D looks a peculiar barred galaxy with two open arms. The continuum of this galaxy is very faint even near its nucleus. Several H II regions are detected throughout the bar and along its arms. The peculiar morphology of this galaxy could be due to the nearby presence of galaxy A that also shows external distorted isophotes. A detailed map of this galaxy is shown in Figure 19. The angular diameter of the group is 10′.6.

HCG 54.—This is a somewhat controversial group because, although it was proposed to be a small group composed of four dwarf galaxies, some authors have lately claimed (e.g., Tikhonov 1990 and references therein) that these were just H II regions belonging to a unique galaxy. Galaxy A was classified as a late-type spiral. A central Hα emission region was detected coincident with the nucleus of this galaxy. However, some knots were detected to the east of this galaxy in what could be the beginning of the arms. Galaxy B is classified as an irregular. Both the *R* band and the Hα morphology show a compact emission region, which suggests that this could be a compact irregular galaxy. Galaxy C was also classified as an irregular, and it shows two Hα emission knots, the brighter of which is coincident with the maximum in the continuum frame. Galaxy D is also an irregular with at least three Hα knots detected. This group shows a faint halo of diffuse emission in the continuum frame, but with no Hα emission at all. The angular diameter of the group is 0′.7.

HCG 61.—This group is composed of four galaxies, three of them with accordant redshifts. Because of this, two Hα frames were combined in order to get the Hα emission of the four galaxies. Galaxy A is a lenticular or early-type spiral. It shows a central extended Hα emission region. Galaxy B is

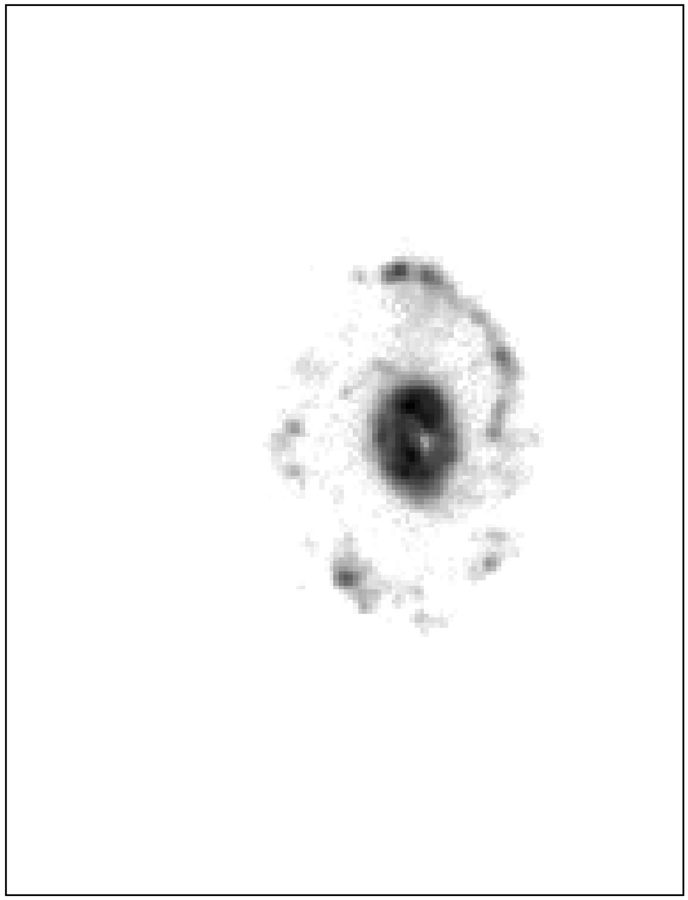


FIG. 18.—Enlarged detail of HCG 16a

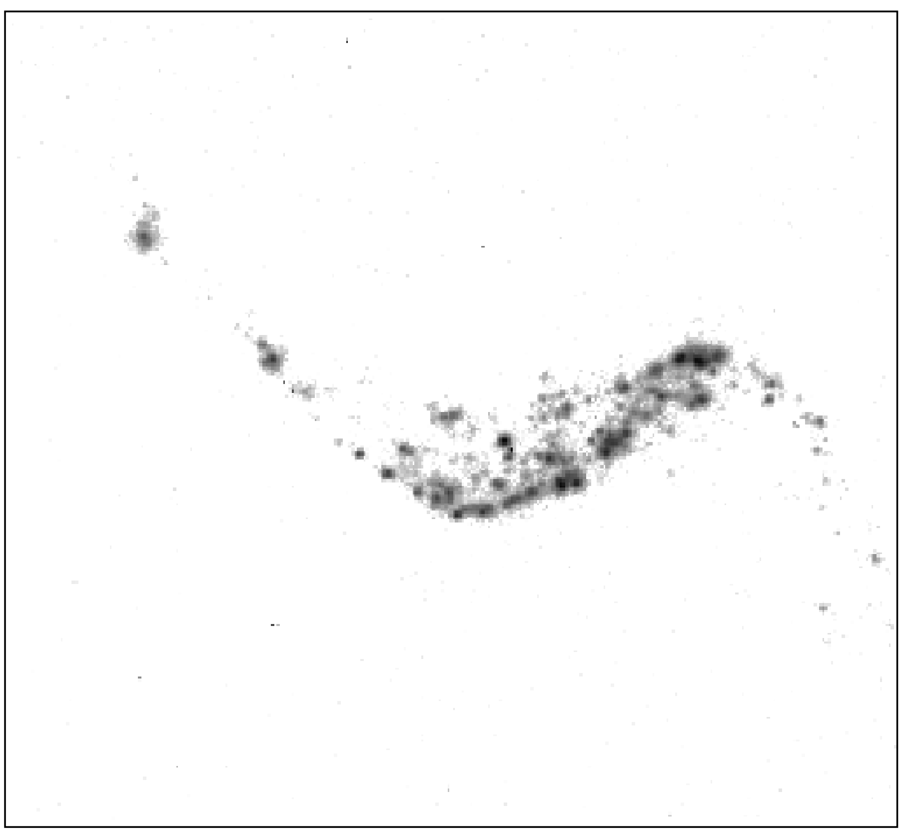


FIG. 19.—Enlarged detail of HCG 44d

the one with discordant redshift. It is classified as irregular and shows many resolved H II regions throughout. In the continuum frame, a tail extending toward the south was detected, although no counterpart for this feature was found in the Hα frame. It could be that this galaxy is not a real member of the group given the difference in radial velocity with the rest of the galaxies. Galaxy C is an edge-on spiral. It shows a dust lane in the continuum frame. The Hα emission region has a maximum coincident with the continuum nucleus and an asymmetric extension along the disk toward the south. Galaxy D is an edge-on lenticular galaxy that shows a centered faint Hα emission region. The angular diameter of the group is 3'.8.

HCG 68.—The subtraction of the continuum frame from the Hα frame was troublesome because of the presence of a bright field star to the western edge of the chip. A non-negligible amount of reflected light coming from this star can be contaminating both the Hα and the continuum frames, and this made the process of subtraction very difficult. Because of this, although the morphology of the galaxies in Hα is basically right, care should be taken with the Hα luminosities because large errors are expected in relation to the true value of the sky level. Galaxy A is a lenticular galaxy. It is almost edge-on and shows a dust lane in the continuum frame. Its Hα morphology shows a disk of emission with no resolved individual features on it. Galaxy B is an elliptical with a central extended region of Hα emission. The brightest isophotes of this galaxy show some distortion that may be produced by the presence of dust. This galaxy and Galaxy A are so close that they have overlapping isophotes. Galaxy C is a barred late-type spiral. It shows a bright knot of Hα emission in the nucleus and no emission along the bar. Several H II regions are detected throughout the disk. Galaxy D is also an elliptical with a central extended region of Hα emission. Galaxy E is a lenticular galaxy with a central Hα-emitting region, like galaxies B and D. The angular diameter of the group is 9'.2.

HCG 79.—This is quite a compact group composed of five galaxies, four of which show accordant redshifts. Galaxy A is a bright elliptical that shows an extended Hα emission region. This galaxy has also been reported by Mendes de Oliveira & Hickson (1994) as a strong radio and IR source. Large amounts of dust have been detected associated with this galaxy. It shows boxy isophotes in the *R*-band frame. Galaxy B is a lenticular galaxy with an extension pointing toward the east. Only the main body of this galaxy shows an Hα emission, although neutral hydrogen has been detected coincident with this extension (Williams, McMahon, & van Gorkom 1991). Because of the presence of this extension, this group is known in all the literature as Seyfert's Sextet. Galaxy C was also classified as a lenticular and does not show any Hα emission. Galaxy D is a late-type spiral almost edge-on. It shows faint Hα emission throughout. This galaxy is coincident with a large cloud of neutral hydrogen that also shows an extension toward the east with no optical counterpart (Williams et al. 1991). Galaxy E is the one that shows discordant redshift. The angular diameter of the group is 1'.3.

HCG 92.—This is quite a famous group, also known as Stephan's Quintet. Given the large differences in the velocities of the galaxies of this group, three filters were used in order to get the Hα emission of all the galaxies. One of the galaxies, the brightest, has discordant redshift with respect to the others. However, strong discrepancies concerning the reality of the discordant redshift of this galaxy have arisen (Shostak, Allen, & Sullivan 1984; Sulentic & Arp 1983) that are not solved even today. Several Hα knots are detected throughout the disk of this galaxy. Galaxy B is a spiral that seems to be interacting with galaxy D. It shows a distorted arm with Hα emission throughout. Also, a large barlike structure of diffuse Hα emission was detected in front of this galaxy (Iglesias-Páramo & Vílchez 1998a). Galaxy C is a barred late-type spiral that shows two distorted arms and a long tidal tail that extends toward the south. The bulk of the Hα emission is concentrated in the inner nucleus. There is also some diffuse Hα emission coming from the disk, but no emission was detected coming from the arms. The southern tip of the tidal tail shows an Hα knot that has been reported as a dwarf galaxy originated in an interacting process (Elmegreen, Kaufman, & Thomasson 1993). No Hα emission was detected corresponding to galaxies D and E, classified as a late-type spiral and an elliptical, respectively.

HCG 93.—This group consists of five galaxies, four of which have accordant redshifts. The faintest galaxy in the group, classified as early-type spiral, presents a discordant redshift with respect the median redshift of the group. Galaxy A is a bright elliptical with a central extended region of Hα emission. Both the continuum and the Hα frames show that the outer isophotes of this galaxy are not elliptical, showing an extended shell of continuum emission that is not detected in Hα. Galaxy B is a barred late-type spiral. This galaxy shows two clear arms that extend out of the bar. The Hα emission is localized along the arms and the bar. Galaxy C is a barred early-type spiral and has been cataloged as a Seyfert 2. This galaxy shows Hα emission concentrated in the inner nucleus. However, the continuum frame shows external distorted isophotes. Galaxy D is a barred lenticular galaxy with Hα emission detected at the 1 σ level. The angular diameter of the group is 9'.0.

HCG 95.—This group is composed of four galaxies, three of which present accordant redshifts. Galaxy A is an elliptical that shows a central compact knot of Hα in its center. Galaxy B presents a radial velocity that is about 3000 km s^{-1} lower than the rest (Iglesias-Páramo & Vílchez 1998b), so we argue that it could be a foreground galaxy. Near this galaxy there is a dwarf object also detected in Hα at a similar wavelength as galaxy B. This object has been proposed to be a dwarf satellite of galaxy B. Galaxy C has been proposed to be a merger of two disk galaxies (Zepf 1993) because it contains two nuclei and shows several tidal tails that are commonly seen in such events. Most of the Hα emission is balanced toward the western nucleus. One of the tidal tails extends out of the bright nucleus and shows strong Hα emission. Almost at the tip of the tail, there is a bright Hα knot that could be the genesis of a dwarf galaxy born in the interaction. In addition, a bridge toward galaxy A is apparent in the continuum frame, but no Hα emission for this feature was detected in our frame. Galaxy D is an edge-on spiral with faint Hα emission across the disk. The angular diameter of the whole group is 1'.5.

HCG 100.—This group consists of four galaxies. There are redshifts available for only three of the galaxies. Galaxy A was classified as an early-type spiral. It shows faint arms compared to its bright bulge in the *R*-band frame. The Hα emission coincides with the central region with faint emission in the inner disk. The nucleus does not show Hα emission at all. Galaxy B is a late-type spiral. Its morphology is quite irregular in the continuum frame. Several regions of

TABLE 2

CHARACTERISTIC PARAMETERS OF THE GALAXIES

Galaxy (1)	R.A. (1950) (2)	Decl. (1950) (3)	Type (4)	v_{hel} (5)	Classification (6)	*B.R.* (7)
2a	00 28 48.85	+08 11 32.0	SBd	4326	RHII	0.19
2b	00 28 43.74	+08 11 57.0	cI	4366	COM	1.00
2c.........	00 28 54.32	+08 07 28.9	SBc	4235	RHII	0.18
7a	00 36 39.66	+00 35 20.5	Sb	4210	NE, RHII	0.65
7b	00 36 44.13	+00 38 17.3	SB0	4238	DIF	1.00
7c.........	00 37 01.15	+00 35 06.3	SBc	4366	NE, RHII	0.23
7d	00 36 45.08	+00 37 00.8	SBc	4116	RHII	0.22
16a	02 06 57.41	−10 22 20.0	SBab	4152	CNE, RHII	0.41
16b	02 06 53.32	−10 22 08.9	Sab	3977	COM	1.00
16c	02 07 11.25	−10 22 56.0	Im	3851	COM	0.93
16d	02 07 15.60	−10 25 11.1	Im	3847	COM	1.00
23a	03 04 30.36	−09 44 09.5	Sab	4798	DIF	0.44
23b	03 04 44.07	−09 47 06.1	SBc	4921	CNE, RHII	0.07
23c	03 04 53.01	−09 48 17.5	S0	5016	DIF	1.00
23d	03 04 29.78	−09 49 17.2	Sd	4562	RHII, NE	0.72
30a	04 33 47.98	−02 55 55.7	SBa	4697	NE, DIF	1.00
30b	04 33 59.72	−02 58 01.9	Sa	4625	NE, DIF	1.00
30c	04 33 52.64	−02 54 02.2	SBbc	4508	COM	1.00
30d	04 34 06.07	−02 56 36.7	S0	4666	...	...
31a	04 59 09.86	−04 19 51.8	Sdm	4042	NE, RHII	0.71
31b	04 59 06.53	−04 20 08.4	Sm	4171	RHII	0.25
31c	04 59 08.91	−04 19 45.5	Im	4068	NE, RHII	0.90
31g	04 59 06.54	−04 19 42.2	IAB(s)m	3991	RHII	0.36
37a	09 10 39.82	+30 11 57.9	E7	6745	NE, DIF	1.00
37b	09 10 32.96	+30 12 24.0	Sbc	6741	DIF	1.00
37c	09 10 37.59	+30 12 23.4	S0a	7357	NE, DIF	1.00
37d	09 10 34.19	+30 13 16.8	SBdm	6207	RHII	0.66
37e	09 10 34.34	+30 14 48.0	E0	6363	NE, DIF	1.00
44a	10 15 20.64	+22 04 54.9	Sa	1293	NE, RHII	0.64
44b	10 15 39.55	+22 08 36.8	E2	1378	DIF	1.00
44c	10 14 53.29	+21 56 18.8	SBc	1218	NE, RHII	0.40
44d	10 15 02.47	+22 07 25.4	Sd	1579	RHII	0.10
54a	11 26 37.92	+20 51 33.2	Sdm	1397	NE	1.00
54b	11 26 36.80	+20 51 25.7	Im	1412	COM	1.00
54c	11 26 39.01	+20 51 43.6	Im	1420	RHII	0.28
54d	11 26 39.25	+20 51 51.3	Im	1670	RHII	0.51
61a	12 09 46.60	+29 27 28.2	S0a	3784	NE	1.00
61c	12 09 59.03	+29 26 47.6	Sbc	3956	NE	1.00
61d	12 09 54.84	+29 25 37.7	S0	3980	NE	1.00
68a	13 51 19.59	+40 31 42.5	S0	2162	NE	1.00
68b	13 51 19.70	+40 32 52.8	E2	2635	NE	1.00
68c	13 51 14.81	+40 36 32.0	SBbc	2313	NE, RHII	0.15
68d	13 51 38.79	+40 35 00.5	E3	2408	COM	1.00
68e	13 51 52.87	+40 31 06.8	S0	2401	COM	1.00
79a	15 56 59.59	+20 53 43.2	E0	4292	NE	1.00
79b	15 57 00.80	+20 54 15.4	S0	4446	NE	1.00
79c	15 56 59.14	+20 54 09.8	S0	4146	...	...
79d	15 57 00.18	+20 53 15.5	Sdm	4503	DIF	1.00
92b	22 33 41.05	+33 42 23.7	Sbc	5774	RHII, DIF	0.11[a]
92c	22 33 46.33	+33 42 57.4	SBc	6764	NE, RHII	0.71
92d	22 33 39.40	+33 42 22.3	Sc	6630	RHII, DIF	0.11[a]
92e	22 33 34.71	+33 41 07.0	E1	6599	...	...
93a	23 12 46.80	+18 41 19.2	E1	5140	COM	1.00
93b	23 12 48.00	+18 46 07.6	SBd	4672	RHII	0.30
93c	23 12 34.43	+18 42 01.3	SBa	5132	DIF	1.00
93d	23 13 03.91	+18 46 30.1	SB0	5173	DIF	1.00
95a	23 16 58.17	+09 14 02.9	E3	11888	NE, DIF	1.00
95c	23 16 56.13	+09 13 14.0	Sm	11562	NE, RHII	0.42
95d	23 16 59.31	+09 13 44.2	Sc	12350	DIF	1.00
100a	23 58 46.33	+12 49 57.2	Sb	5300	CNE	0.55
100b	23 58 52.35	+12 50 03.8	Sm	5253	RHII	0.62
100c	23 58 39.75	+12 51 56.1	SBc	5461	RHII	0.78
100d	23 58 41.00	+12 50 03.3	Scd	...	RHII	0.48

NOTE.—Col. (1): Galaxy identifier. Col. (2): Right ascension, in units of hours, minutes, and seconds. Col. (3): Declination, in units of degrees, arcminutes, and arcseconds. Col. (4): Morphological type following Hickson et al. 1989. Col. (5): Heliocentric velocity in km s $^{-1}$. Col. (6): Hα classification according to the following criteria: COM (one compact emission region), NE (nuclear emission), CNE (circumnuclear emission), RHII (several H II regions resolved), DIF (diffuse emission). Col. (7): Ratio between the flux of the brightest region and the total emission of the galaxy.

[a] The Hα emission of both galaxies has been considered together.

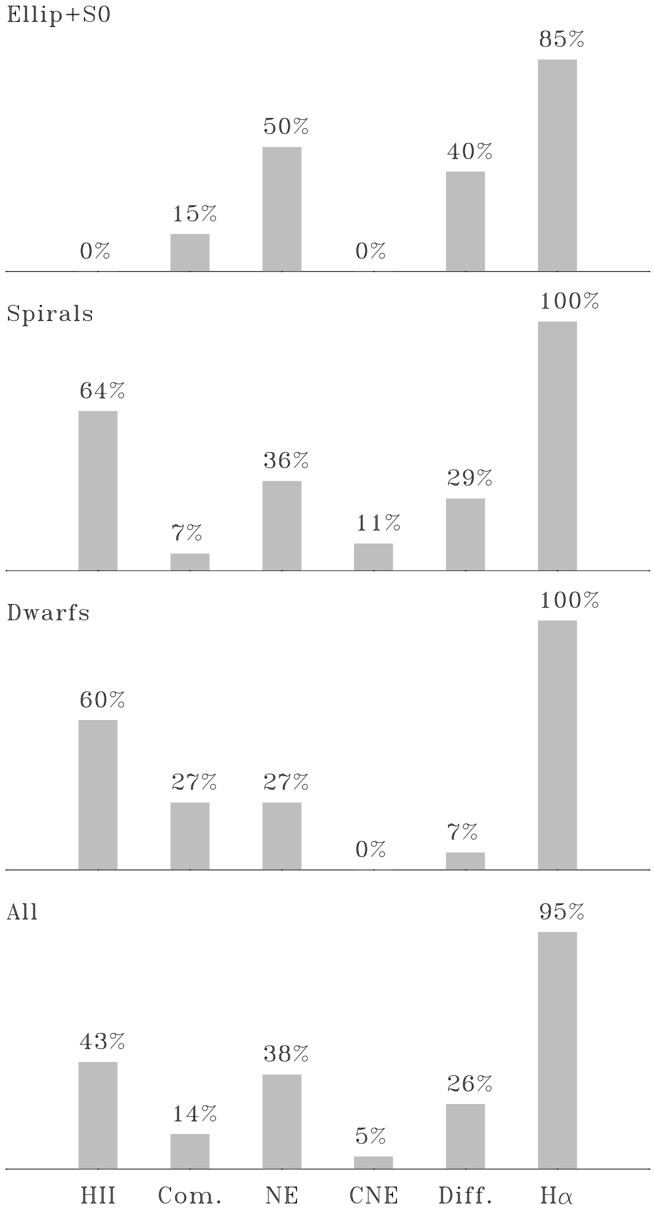


FIG. 20.—Distribution of the Hα emission of the galaxies in our sample. The three upper panels show the distribution for each morphological type. The lower one shows the total distribution. Each galaxy can be classified in more than one category.

Hα emission are detected, with the brightest of them concentred toward the center of the galaxy. Galaxy C is a barred late-type spiral. It shows a central Hα emission region and some faint emission regions in the outer disk. Although no information about the radial velocity of galaxy D is available, Hα emission was detected for this galaxy, which is classified as a late-type spiral. Thus, the radial velocity of this galaxy should be accordant with the median for the group. Several knots of Hα were detected for this galaxy throughout its disk. The angular diameter of the group is 3′.6.

5. DISCUSSION

Table 2 shows some of the characteristic parameters of the galaxies of our sample. Column (1) shows the parent name of the galaxy as in Hickson (1982). Columns (2) and (3) show the coordinates of the galaxies taken from Hickson, Kindl, & Auman (1989). Column (4) gives the morphological type of the galaxies according to the RC3 classification (de Vaucouleurs et al. 1991). Column (5) gives the radial velocities of the galaxies taken from Hickson et al. (1992). Column (6) show the classification of each galaxy according to the following criteria: COM (one compact emission region), NE (nuclear emission), CNE (circumnuclear emission), RHII (several H II regions resolved), and DIF (diffuse emission). The galaxies were classified by eye, and a single galaxy can fit more than one category. Column (7) shows the ratio between the Hα emission of the brightest H II region and the total Hα luminosity of the galaxy. All the galaxies for which we did not detect any individual H II region present a value of $B.R. = 1$. Figure 20 shows the histogram of the fractions of galaxies classified following the criterion indicated in column (6) of Table 2, separated by galactic type. The bar to the right of the figure indicates the total fraction of galaxies that show Hα emission. It is noticeable that a large fraction of ellipticals and lenticulars are detected in Hα. However, recent papers about Hα emission in ellipticals stress the increasing number of early-type galaxies that show Hα emission (Goudfrooij et al. 1994; Macchetto et al. 1996) compared to previous published surveys. Three of the galaxies, HCG 16c, HCG 16d, and HCG 95a, show a bipolar-like Hα morphology. This effect could be related to the existence of dust surrounding the emission region. A clearer example is the case of HCG 23C, an edge-on spiral that shows two disconnected Hα emission regions due to the cumulated distribution of dust on the galactic plane.

We notice that only three of the spirals show circumnuclear Hα emission. The latter has been frequently associated with activity and/or interactions in galaxies. However, except for HCG 16a, no clear signs of interaction have been detected in the other two galaxies. Also, six of the spirals were found to contain nuclear Hα emission. However, just two of the galaxies in our sample have been previously classified as Seyfert galaxies.

Clear morphological signs of interactions have been found in seven of the groups: HCG 16, HCG 31, HCG 54, HCG 68, HCG 79, HCG 92, and HCG 95. However, just three of them (HCG 31, HCG 92, and HCG 95) show Hα emission in the tidal features. This means that the triggering of star formation in the tidal features developed during an interaction between two disk galaxies must depend on several parameters. In addition, in the three cases mentioned, dwarf emission-line galaxy candidates have been found at the tips of the tidal tails. The formation of such dwarf galaxies was originally proposed by Zwicky (1956) and has been found for other interacting pairs of galaxies (see, e.g., Mirabel, Dottori, & Lutz 1992).

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