

# Parkes HI observations of galaxies behind the southern Milky Way

## II. The Crux and Great Attractor regions ( $l \approx 289^\circ$ to $338^\circ$ )<sup>\*,\*\*</sup>

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Received 28 May 2009 / Accepted 15 July 2009

### ABSTRACT

As part of our programme to map the large-scale distribution of galaxies behind the southern Milky Way, we observed 314 optically-selected, partially-obscured galaxies in the Zone of Avoidance (ZOA) in the Crux and Great Attractor (GA) regions. An additional 29 galaxies were observed in the Vela ZOA survey region (because of the small numbers they are not discussed any further). The observations were conducted with the Parkes 64 m (210 ft) radio telescope, in a single-pixel pointed mode, reaching an rms noise level of typically 2–6 mJy over the velocity search range of  $400 < v < 10\,500$  km s<sup>-1</sup>. A total of 162 galaxies were detected (plus 14 galaxies in the Vela region). The detection rate is slightly higher than for the Hydra/Antlia region (52% versus 45%) observed in the same way. This can be explained by the prominence of the GA overdensity in the survey regions, which leads to a relatively higher fraction of nearby galaxies. It is also evident from the quite narrow velocity distribution (largely confined to 3000–6000 km s<sup>-1</sup>) and deviates significantly from the expectation of a uniform galaxy distribution for the given sensitivity and velocity range. No systematic differences were found between detections and non-detections, in terms of latitude, foreground extinction, or environment, except for the very central part of the rich Norma cluster, where hardly any galaxies were detected. A detailed investigation of the HI content of the galaxies reveals strong HI deficiency at the core of the Norma cluster (within about a 0.4 Abell radius), similar to what has been found in the Coma cluster. The redshifts obtained by this observing technique result in a substantial reduction of the so-called redshift ZOA. This is obvious when analysing the large-scale structure of the new HI data in combination with data from other (optical) ZOA redshift surveys. The lower latitude detections provide further evidence of the extension of the Norma Wall, across the ZOA, in particular its bending towards the Cen-Crux clusters above the Galactic plane at slightly higher redshift, rather than a straight continuation towards the Centaurus clusters.

**Key words.** catalogs – surveys – ISM: dust, extinction – galaxies: fundamental parameters – radio lines: galaxies – cosmology: large-scale structure of Universe

### 1. Introduction

Revealing the three-dimensional distribution of galaxies over the entire sky including the regions behind the dust and stars of our Milky Way is important for understanding the motion of the Local Group with respect to the microwave background as well as the peculiar flow fields in the nearby Universe (e.g., review by Kraan-Korteweg & Lahav 2000; Kraan-Korteweg 2005; and contributions in “Mapping the Hidden Universe”, 2000, ASP CS 218, eds. Kraan-Korteweg et al. 2000; “Nearby Large-Scale Structures and the Zone of Avoidance”, 2005, ASP CS 329, eds. Fairall & Woudt 2005). Except for blind HI surveys where both the angular coordinates and redshifts of galaxies are simultaneously detected, this is a two-step process: first the galaxies have to be identified (in the optical, near or far-infrared), then

redshifts have to be determined in follow-up studies. This has been done in the optical, either as single-channel or multi-fibre spectroscopy depending on surface brightness of the galaxies and the galaxy density on the sky or in the radio using the 21 cm spectral line of neutral hydrogen. The latter is most effective for the most obscured and/or low surface brightness spirals and irregular galaxies.

Based on the deep optical galaxy catalogues in the southern Zone of Avoidance (ZOA; Kraan-Korteweg 2000; Woudt & Kraan-Korteweg 2001), we have obtained pointed HI observations of a sample of obscured spiral galaxies with the 64 m Parkes radio telescope in Australia. Previous results of the Hydra/Antlia region ( $266^\circ \lesssim l \lesssim 296^\circ$ ) were presented in Kraan-Korteweg et al. (2002, hereafter Paper I). The second part, presented here, covers the observations of spiral galaxies in the Crux and Great Attractor regions (hereafter GA;  $289^\circ \lesssim l \lesssim 338^\circ$ ,  $-10^\circ \lesssim b \lesssim +10^\circ$ ; Woudt & Kraan-Korteweg 2001). The optical search detected galaxies above a diameter limit of  $D \geq 0.2$  on IIIaJ film copies of the ESO/SRC sky survey. For a detailed description of the optical search, see Paper I and

\* Figure 1 is only available in electronic form at <http://www.aanda.org>

\*\* Table 1 is also available in electronic form at the CDS via anonymous ftp to [cdsarc.u-strasbg.fr](http://cdsarc.u-strasbg.fr) (130.79.128.5) or via <http://cdsweb.u-strasbg.fr/cgi-bin/qcat?J/A+A/505/1049>

the optical catalogue papers (Kraan-Korteweg 2000; Woudt & Kraan-Korteweg 2001). In summary, our target list consisted of spiral galaxies without redshift information at the time of observation, which have extinction-corrected diameters larger than  $D^0 > 60''$  (based on the Schlegel et al. 1998 extinction maps, and the Cameron 1990 correction laws). This corresponds to the completeness limit of the deep optical ZOA galaxy catalogues to foreground extinction levels of  $A_B \leq 3^m0$  (Kraan-Korteweg 2000). It will therefore complement existing optical whole-sky catalogues such as Nilson (1973) for the northern sky and Lauberts (1982) for the southern sky. The ESO/SRC IIIaJ film-copies that were used for the searches have such fine-grained emulsion and sensitivity that the spiral morphology could always be discerned with our 50× magnifying viewer – though not always the spiral sub-type. At the highest extinction levels, we also targeted smaller galaxies since optical spectroscopy is unlikely to succeed in yielding redshifts for these heavily extinguished galaxies. We also sampled deeper in some of the overdensities like, e.g., the Norma cluster.

Our sample has a sensitivity of 2–6 mJy. This study is therefore complementary to the systematic blind HI survey of the southern ZOA conducted with the Parkes multibeam receiver (Staveley-Smith et al. 2000; for preliminary results see Kraan-Korteweg et al. 2005; Henning et al. 2005), which covers the optically opaque part of the southern ZOA ( $212^\circ \leq \ell \leq 36^\circ$ ,  $|b| \leq 5^\circ$ ) for the velocity range  $-1200$  to  $12700$  km s<sup>-1</sup>, with a sensitivity similar to the observations presented here. A subsample of this work consists of the shallow HI ZOA survey (hereafter HIZSS; Henning et al. 2000), based on 8% of the integration time of the full survey with a sensitivity of 15 mJy beam<sup>-1</sup> after Hanning smoothing). In another subsample which is based on 16% of the integration time of the full survey, Juraszek et al. (2000, hereafter JS00) focused on the area of the GA in the ZOA ( $308^\circ \leq \ell \leq 332^\circ$ ).

In the following section, a short description of the observations is given (see Paper I for further details). Section 3 presents the HI data and line profiles of the detected galaxies. In Sect. 4, the non-detected galaxies are listed with their respective velocity search range. An analysis of the properties of the detected galaxies, the velocity distribution as well as the detection rate (Sect. 5) is followed by a detailed discussion of HI-deficiency in the Norma cluster (Sect. 6). We then present a description of the three-dimensional galaxy distribution in and around the investigated area (Sect. 7). A summary is given in Sect. 8. Throughout the paper we assume a Hubble constant of  $H_0 = 70$  km s<sup>-1</sup> Mpc<sup>-1</sup>.

In Appendix A, we discuss cross-identifications of optical galaxies for which the detected HI signal might not necessarily be associated with the optical counterpart, or where more than one galaxy was detected in one pointing. In Appendix B, we present detections in the Vela region ( $245^\circ \lesssim \ell \lesssim 275^\circ$ ) which have also been observed during the course of these observing runs.

## 2. Observations

The Parkes 64 m radio telescope<sup>1</sup> was used over four observing periods of about 10–14 days each (June 1993, April 1994, July 1995 and September 1996). Here, we report on the observations that cover the Crux and GA ZOA regions.

<sup>1</sup> The Parkes telescope is part of the Australia Telescope which is funded by the Commonwealth of Australia for operation as a National Facility managed by CSIRO.

A detailed description of the observational set-up is given in Paper I. A summary of the main characteristics of the observations is given below.

At 21 cm, the telescope has a half-power beam-width (HPBW) of 15'. The system temperature was typically 39 K at the time of these observations. Typical integration times were a total of 30 min each on the source (ON) and on a reference position (OFF). Strong sources had shorter integration times (10 or 20 min) while weaker possible detections were reobserved until the reality of the signal was clearly determined. Based on calibrating observations the internal consistency of the flux scale is about  $\pm 15\%$ .

In 1993, we used the 1024-channel auto correlator with a bandwidth of 32 MHz, covering, in most cases, the radial velocity range 300–5500 km s<sup>-1</sup>, with some additional observations centred at 7500 km s<sup>-1</sup>; the channel spacing was 6.6 km s<sup>-1</sup> and the velocity resolution after Hanning smoothing was 13.2 km s<sup>-1</sup>. From 1994 on, we covered the range 300–10500 km s<sup>-1</sup> with a channel spacing of 13.2 km s<sup>-1</sup> and a velocity resolution after Hanning smoothing of 27.0 km s<sup>-1</sup>.

## 3. Detections

In the following, we present the parameters of the 162 detected galaxies, from the sample of 314 target galaxies. The data were reduced using the Spectral Line Analysis Program (Staveley-Smith 1985). The two orthogonal polarisations were averaged during reduction, and a low-order polynomial baseline subtracted from each spectrum. The reduced HI spectra are shown in Fig. 1 which is available online at A&A. The optical properties as well as the HI parameters are given in Table 1. The columns in the table are described below. A colon after an entry indicates an uncertain value.

*Column 1:* identification as given in the optical Crux/GA ZOA galaxy catalogue (Woudt & Kraan-Korteweg 2001). A few galaxies from Yamada et al. (1993), which are all IRAS-selected galaxies, had been added to the observing programme. Their names start with “Y” and have the ESO-galaxy number or the IRAS number attached to it. A question mark after the name denotes an uncertain identification of the HI signal, and a plus indicates that more than one signal was found in the pointing or in the associated OFF-observation.

*Column 2:* second name as found by NED<sup>2</sup> in the order of NGC, IC, ESO, and other catalogue names. Most of the second identifications originate from the ESO/Uppsala Survey of the ESO(B) Atlas (Lauberts 1982). Other names come from the following catalogues: NGC stands for the New General Catalogue (Dreyer 1888), IC stands for the Index Catalogue (Dreyer 1908), FGCE stands for the Flat Galaxy Catalog (Karachentsev et al. 1993), AM for Arp & Madore (1987), CSRG for Catalog of Southern Ringed Galaxies (Buta 1995), HIZSS for the HI Parkes ZOA Shallow Survey (Henning et al. 2000), and HIZOA for Juraszek et al. (2000).

*Column 3:* identification in the infrared (IR) and near-infrared (NIR): “I” indicates an entry in the IRAS Point Source Catalog according to the precepts explained in Woudt & Kraan-Korteweg (2001); “M” or “D” indicates an entry in the 2MASS Extended Objects Catalogue (2MASS, 2003) and the DENIS catalogue by Vauglin et al. (2002), respectively.

*Columns 4 and 5:* Right Ascension RA and Declination Dec (J2000.0).

*Columns 6 and 7:* Galactic longitude and latitude  $\ell$  and  $b$ .

<sup>2</sup> the NASA/IPAC Extragalactic Database.

*Column 8:* morphological type. The morphological types are coded similarly to the precepts of the RC2 (de Vaucouleurs et al. 1976) with the addition of the subtypes E, M and L, which stand for early spiral (S0/a–Sab), middle spiral (Sb–Sd) and late spiral or irregular (Sdm–Im), respectively. (Note that the uncertainty of the bar presence is indicated by “Y” as in Woudt & Kraan-Korteweg (2001), rather than the standard “X” as in the RC2. We have kept their denotation.)

*Column 9:* major axis diameter  $D$  and minor axis diameter  $d$  in arcseconds.

*Column 10:* apparent magnitude  $B_J$ . These magnitudes are eye-estimates from the ESO/SERC IIIaJ film copies. They compare well with the Lauberts & Valentijn (1989)  $B_{25}$  magnitudes and have a  $1\sigma$ -dispersion of less than  $0^m.5$ .

*Column 11:* the Galactic reddening at the position of the galaxy, as given by the DIRBE/IRAS extinction maps (Schlegel et al. 1998). See the catalogue paper (Woudt & Kraan-Korteweg 2001) for a more detailed discussion.

*Column 12:* heliocentric HI radial velocity in  $\text{km s}^{-1}$  taken at the midpoint of the HI profile at the 20% level. The velocity is given in the optical convention  $V = c \cdot (\lambda - \lambda_o) / \lambda_o$ . The uncertainty on the velocities,  $\sigma_V$ , can be determined following Schneider et al. (1986) using  $1.5(\Delta V_{20} - \Delta V_{50})(S/N)^{-1}$ , where  $S/N$  is the ratio of the peak signal to rms noise level. The median error over all detections is  $3.6 \text{ km s}^{-1}$ .

*Column 13:* velocity width in  $\text{km s}^{-1}$  of the HI profile measured at the 50% level of the peak intensity. The expected error is  $2.0\sigma_V$  (Schneider et al. 1986), and the median error derived from the table is  $7.3 \text{ km s}^{-1}$ .

*Column 14:* velocity width in  $\text{km s}^{-1}$  of the HI profile measured at the 20% level of the peak intensity. The expected error is  $3.1\sigma_V$  (Schneider et al. 1986), and the median error derived from the table is  $11.3 \text{ km s}^{-1}$ .

*Column 15:* integrated HI flux density, in  $\text{Jy km s}^{-1}$ , uncorrected for finite beam size. The uncertainty on the flux densities,  $\sigma_I$ , can be determined following Schneider et al. (1990) using  $2(1.2\Delta V_{20}/R)^{0.5}R\sigma$ , where  $R$  is the velocity resolution of the data (see Sect. 2) and  $\sigma$  is the rms noise level. The median error over all defined flux densities is  $0.65 \text{ Jy}$ .

*Column 16:* rms noise level in mJy measured over the region used to fit a baseline, typically of a width of  $1600 \text{ km s}^{-1}$  centred on, but not including, the detection.

*Column 17:* most spectra have been Hanning-smoothed, except when the line width was smaller than  $100 \text{ km s}^{-1}$  or for other reasons (see footnotes to the table), which is indicated with an “n” for “no Hanning-smoothing”.

*Column 18:* a star indicates a footnote for this entry.

*Column 19:* angular distance of the detected galaxy from the centre of the beam in arcminutes. Sometimes the telescope was not pointed towards the galaxy listed as, e.g., in a close pair or when there was a second detection in the beam. As the sensitivity of the beam decreases with distance to the beam centre, the fluxes will have higher uncertainties (see Col. 20).

*Column 20:* corrected flux densities for off-centre detections. The sensitivity decreases as a function of the distance from the beam centre. The observed flux density of galaxies detected away from the central pointing will be underestimated. We have provided a rough correction for such galaxies by assuming that the beam sensitivity can be approximated by a circular Gaussian. This correction becomes uncertain for distances above the beam radius, i.e.,  $7/5$ .

*Column 21:* excised RFI (radio frequency interference) on or near the detected HI profile.

The galaxy density in the Crux and particular in the GA region is quite high. In 16% of the pointings, more than one galaxy was found within the  $1\sigma$  beam radius. In most cases the proper identification of the detected galaxy was straightforward (by comparing size, morphological type, optical velocity if available, and distance from the beam centre). In questionable cases we have made use of the HIPASS public data release<sup>3</sup> (as a blind survey it is independent of our pointed observations) to specify the origin of a signal. In a few cases the identification of the detection remains ambiguous or the counterpart could not be found at all. Due to the high extinction in these regions, low surface brightness (late-type) spiral galaxies are often too obscured to be visible. In other cases the detection is a combination of the signals from two or even more galaxies and the individual HI parameters are uncertain or could not be derived. The problematic cases are discussed in more detail in Appendix A.

We have compared our detected velocities with independent velocity determinations in the literature. Table 2 gives the galaxy IDs for which we have found velocity determinations, their observed velocity (from Col. 12 in Table 1), the velocity from the literature and its error, the origin of the measurement (optical or HI), and the reference (as explained in Table 3).

Since we did not repeat observations at Parkes for galaxies with already existing HI data, most of the given independent velocities originate from optical spectroscopy. A number of strong HI sources were subsequently detected with HIZSS, JS00 and/or with HIPASS.

The HI velocities measured by HIPASS with the Multibeam (MB) receiver compared to our single beam observations are in very good agreement. The  $1\sigma$ -dispersion of 31 galaxies in common is  $11 \text{ km s}^{-1}$  (including only velocities with HIPASS error measurements  $<10 \text{ km s}^{-1}$ ). A comparison with HIZSS gives a dispersion of  $6.5 \text{ km s}^{-1}$  for 7 galaxies. The agreement with optical velocities is also satisfactory, giving a dispersion of  $100 \text{ km s}^{-1}$  for 50 measurements with errors  $<100 \text{ km s}^{-1}$  (excluding one wrong measurement for WKK 5416).

The line width measurements also agree well with HIPASS albeit with a larger scatter of  $28 \text{ km s}^{-1}$  for both 50% and 20% line widths (using 29 measurements, excluding all uncertain measurements).

While the shallower HIPASS survey detected all galaxies with peak flux density  $>120 \text{ mJy}$ , the majority of our detections have peak flux densities  $<70 \text{ mJy}$ , see Fig. 2. Most of the HIPASS detections below  $70 \text{ mJy}$  have larger uncertainties, while our survey becomes incomplete only at  $<20 \text{ mJy}$ . This compares well with the distribution of rms noise in our survey: the median rms level lies at  $3.8 \text{ mJy}$ . The majority of detections have an rms noise level between 2 and 6 mJy. For comparison, the rms noise for HIPASS typically is 13 mJy, though expected to be slightly higher in the Galactic plane. This indicates that we are sensitive enough to detect  $M^*$  galaxies in the GA region – contrary to the blind HIPASS.

Comparing integrated flux densities with HIPASS gives a  $1\sigma$ -dispersion of 25% of the flux for 23 measurements (uncertain measurements excluded). Reducing the acceptable HIPASS error on velocities from  $9 \text{ km s}^{-1}$  to  $8 \text{ km s}^{-1}$  (cf. the comparison of HI velocities above) the  $1\sigma$ -dispersion is 15% of the flux (for 19 measurements), which is more comparable with what we find for the calibrators (cf. Sect. 2). Table 1 lists 14 galaxies offset from the beam centre. A comparison of the corrected fluxes

<sup>3</sup> Data provided by the ATNF under the auspices of the Multibeam Survey Working Group, see <http://www.atnf.csiro.au/research/multibeam/release/>

Table 1. HI-detections in the Crux and Great Attractor region.

Ident.	Other	IR	RA (h m s)	Dec (deg ' ")	gal $\ell$ (deg)	gal $b$ (deg)	Type	$D \times d$ (")	$B_I$ ( $m$ )	$E_{(B-V)}$ ( $m$ )	$V_{hel}$ km s $^{-1}$	$\Delta V_{50}$ km s $^{-1}$	$\Delta V_{20}$ km s $^{-1}$	$I$ Jy km s $^{-1}$	rms hann mJy	$N$	dist ( $'$ )	$I_c$ Jy km s $^{-1}$	excised RFI km s $^{-1}$	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
WKK0143	FGCE0850	M	10 57 03.6	-70 10 34	293.46	-9.44	S	5	112 × 11	16.4	0.23	4353	296	316	9.64	4.6				
WKK0204	ESO063-G006	M	11 09 03.2	-68 34 42	293.77	-7.55	S	?	51 × 27	16.0	0.24	4349	227	249	10.46	4.5				
WKK0207		MI	11 09 15.5	-70 15 17	294.45	-9.08	SY	4	48 × 32	15.8	0.22	9290	266	317	5.57	3.0				
WKK0285	ESO063-G014	I	11 30 21.8	-70 10 59	296.11	-8.39	S	7	54 × 28	16.2	0.41	4017	183	227	2.90	2.0				
WKK0304	ESO063-G017	MI	11 38 55.2	-69 57 43	296.75	-7.96	S	5	81 × 23	15.7	0.45	3813	294	331	15.51	6.8				
WKK0491+	ESO171-G003	M	11 58 48.4	-55 19 01	295.44	6.79	S	5	73 × 15	16.3	0.24	7353	451	475	8.86	3.3				
WKK05127+		M	11 59 54.9	-55 11 03	295.57	6.95	S	L	28 × 8	18.0	0.25	4617	152:	169:	1.12:	2.1	12.4	7.4		
WKK0539		M	12 01 20.0	-53 47 56	295.49	8.35	S	5	73 × 62	15.0	0.21	7562	175	203	11.30	5.3				
WKK0662	ESO171-G011	M	12 08 35.3	-54 05 59	296.61	8.25	S	4	55 × 8	17.0	0.18	5603	311	333	3.97	3.7				
WKK0696		M	12 10 13.3	-70 02 06	299.40	-7.45	S	5	60 × 31	15.9	0.26	11729	410	433	2.81	2.4				
WKK0788		I	12 14 25.4	-58 26 53	298.09	4.08	S	5	59 × 11	17.0	0.60	5643	292	337	7.15	3.9			5900	
WKK0793		M	12 14 45.5	-69 41 15	299.74	-7.04	S	5	78 × 8	17.1	0.29	5366	269	296	4.29	4.1			4750	
WKK0850		M	12 17 29.3	-53 21 25	297.81	9.18	S	P	48 × 24	15.9	0.17	5964	214	245	3.21	2.9				
WKK0969+		M	12 23 06.5	-58 06 48	299.19	4.55	?		16 × 12	18.5	0.66	4598	195	228	4.25:	2.5	*	8.5	10.4	
WKK0994		M	12 24 43.7	-70 16 09	300.66	-7.52	S	6	40 × 34	16.2	0.36	5343	172	232	3.74	4.0				
WKK1045		M	12 27 47.6	-53 14 45	299.35	9.46	S	3	50 × 42	15.4	0.17	5411	172	190	2.47	2.8				
WKK1089	ESO172-G004	M	12 31 02.2	-55 08 14	299.99	7.62	I		85 × 54	14.5	0.44	1712	146	183	33.61	6.8				
WKK1117+	ESO131-G010	M	12 32 50.9	-58 01 30	300.46	4.76	S	5:	43 × 19	16.5	0.71	4256	264	287	4.88	2.5				
WKK1294	ESO172-G006	M	12 43 12.7	-52 47 47	301.67	10.06	S	3	74 × 31	15.6	0.17	1919	110	128	3.16	3.8				
WKK1342		M	12 45 46.6	-55 40 42	302.13	7.18	S	5	65 × 17	16.5	0.55	5386	256	286	8.18	3.1				
WKK1352	ESO172-G008	M	12 46 12.9	-56 44 22	302.21	6.12	SY	4:	67 × 42	15.2	0.42	5437	227	257	6.71	6.8				
WKK1446		M	12 51 41.0	-52 43 10	302.97	10.15	S	3	47 × 27	16.2	0.23	3677	207	226	9.98	4.3				
WKK1455	ESO172-G011	M	12 52 12.2	-53 29 37	303.05	9.38	S	7	81 × 34	15.5	0.32	3692	211	227	6.43	4.0				
WKK1510		M	12 54 51.6	-55 53 54	303.42	6.97	S	4	66 × 11	16.5	0.43	2668	123	176	1.76	3.8				
WKK1608		M	12 58 43.4	-56 48 54	303.93	6.04	SB	4	63 × 40	15.4	0.52	5938	262	319	4.39	2.6				
WKK1696		I	13 02 26.8	-56 08 55	304.48	6.69	S	5	78 × 15	16.7	0.36	6684	288	312	4.31	2.3				
WKK1752		M	13 05 06.1	-70 16 38	304.09	-7.44	S	7	95 × 12	16.6	0.38	2475	179	204	6.17	4.5				
WKK1972	ESO173-G008	M	13 12 38.2	-57 03 45	305.82	5.69	S	6	85 × 31	15.6	0.48	5651	287	309	8.96	4.0				
WKK2029	HIZSS077	M	13 15 09.9	-58 56 11	306.00	3.79	S	M	47 × 31	15.8	0.90	2349	157	221	31.67	4.2				
WKK2147	ESO173-G011	MI	13 21 59.7	-54 36 45	307.39	7.99	S	5	105 × 28	15.0	0.41	4180	431	454	5.87	3.7	0.1	5.9		
WKK2163?	ESO220-G006	M	13 22 52.0	-52 44 36	307.75	9.83	S	6	74 × 56	15.3	0.31	3533	155	185	8.27	4.0				
WKK2171		MI	13 23 30.3	-56 18 31	307.40	6.28	S	L	43 × 38	16.5	0.75	3630	262	289	7.31	3.2				
WKK2172		M	13 23 27.9	-53 30 05	307.74	9.07	S	5	60 × 36	15.9	0.39	4029	191	223	3.73	2.3				
WKK2201	ESO173-G013	M	13 25 19.8	-53 32 13	308.02	9.00	S	7	56 × 46	15.9	0.33	4061	121	146	3.58	3.6				
WKK2203		M	13 25 24.8	-56 09 47	307.68	6.40	S	5	59 × 9	17.6	0.58	3709	218	238	6.13	3.3				
WKK2215		I	13 25 46.5	-55 09 36	307.86	7.38	S	5	70 × 10	15.1	0.49	7520	274	299	8.36	3.4				
WKK2222	ESO173-G014	M	13 26 16.3	-55 29 07	307.89	7.05	S	3:	70 × 51	15.3	0.48	2582	81	123	7.72	8.8	n			
WKK2245	HIZSS078	M	13 27 43.0	-57 29 05	307.81	5.04	SY		70 × 50	15.6	0.80	2912:	272:	335:	28.17:	5.5				
WKK2254		I	13 27 59.0	-54 58 09	308.21	7.53	S	5:	74 × 23	15.9	0.43	5518	279	319	7.67	3.7				
WKK2301		M	13 31 48.7	-65 16 37	307.14	-2.74			20 × 12	17.7	1.26	2775	286	303	10.05	5.9				
WKK2369		M	13 35 38.8	-52 41 34	309.70	9.60	S	6	54 × 7	17.8	0.34	6264	224	270	4.06	3.5				
WKK2372		I	13 36 12.3	-56 32 22	309.11	5.79	S	L	71 × 54	15.3	0.70	4058	201	223	11.88	5.3				

Table 1. continued.

Ident.	Other	IR	RA (h m s)	Dec (deg ' ")	gal $\ell$ (deg)	gal $b$ (deg)	Type	$D \times d$ (")	$B_J$ ( $m$ )	$E_{(B-V)}$ ( $m$ )	$V_{\text{hel}}$ $\text{km s}^{-1}$	$\Delta V_{50}$ $\text{km s}^{-1}$	$\Delta V_{20}$ $\text{km s}^{-1}$	$I$ $\text{Jy km s}^{-1}$	rms hann $\text{mJy}$	$N$	dist ( $'$ )	$I_c$ $\text{Jy km s}^{-1}$	excised RFI $\text{km s}^{-1}$	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
WKK2377		M	13 36 35.9	-54 55 55	309.44	7.37	S	7:	70x 23	16.1	0.56	4282	301	329	11.93	4.5				
WKK2388++		MI	13 37 17.0	-55 04 34	309.52	7.21	S	5	36x 16	17.0	0.57	3938	281	331	9.29	3.8	0.7	9.3		
WKK2390+		MI	13 37 24.5	-58 52 21	308.85	3.47	S	E	54x 12	16.6	1.09	3659:	364:	516:	20.78:	3.7	1.2	21.2		
WKK2392+		MI	13 37 32.6	-58 50 06	308.88	3.50	I	?	24x 13	17.2	1.09	3659:	364:	516:	20.78:	3.7	3.2	23.6		
WKK2402		I	13 38 10.5	-56 28 39	309.39	5.81	SB	5	120x 85	14.1	0.58	3947	311	343	27.32	6.7	0.5	27.4		
WKK2406		M	13 38 18.2	-55 04 16	309.66	7.19	S	L	55x 38	15.9	0.62	4264	216	235	9.76	4.1				
WKK2433	ESO066-G001	MI	13 40 21.7	-71 07 45	306.91	-8.64	S	5	78x 44	14.8	0.42	5335	403	431	7.38	4.4	0.1	7.4		
WKK2503+	HIZSS083	MI	13 44 55.8	-65 40 52	308.41	-3.38	S		85x 43	15.2	0.89	2794:	329:	396:	29.93:	7.8	0.8	30.2		
WKK2503B+							(LSB)			0.89	2794:	329:	396:	29.93:	7.8	...	...	...		
WKK2542	ESO174-G001		13 47 58.3	-53 20 55	311.41	8.59	I	?	208x 56	14.0	0.50	684	75	109	57.91	8.8	n			
WKK2576++		MI	13 50 29.2	-52 56 47	311.87	8.90	S	5:	86x 75	14.6	0.41	3883:	171:	216:	...	3.7	*	8.4	...	
WKK2595++	AMI1348-524	M	13 51 23.3	-52 54 49	312.01	8.90	S	6	102x 40	14.9	0.39	3886:	171:	268:	23.30:	3.7				
WKK2596	HIZSS084	MI	13 51 38.7	-58 35 19	310.72	3.37	S	?	32x 12	17.8	1.00	3867	646	682	25.61:	3.4			3650	
WKK2597++	AMI1348-524	MI	13 51 30.5	-52 55 22	312.03	8.88	S	5	59x 47	15.0	0.39	3886:	171:	268:	23.30:	3.7	1.2	23.7		
WKK2640+		MI	13 53 38.8	-52 55 03	312.35	8.81	I	51x 42	15.9	0.40	3705	49	109	4.84	4.8	n				
WKK2644+		MI	13 53 47.1	-52 50 58	312.38	8.87	S	M	26x 9	17.8	0.40	9404	254:	341:	6.72:	3.8	4.3	8.4	10100	
WKK2670	ESO174-G002	MI	13 54 33.4	-53 18 41	312.38	8.40	S	L	121x 19	15.7	0.43	3821	346	379	6.77	3.7				
WKK2693	ESO066-G003	M	13 56 37.1	-70 55 38	308.25	-8.73	S	5	118x 16	15.7	0.29	7081	432	452	6.36	3.9				
WKK2722		M	13 57 21.0	-54 33 27	312.47	7.09	S	5	78x 15	16.2	0.40	3984	251	285	9.43	2.3				
WKK2804	CSRG0755	MI	14 00 26.4	-53 43 31	313.13	7.77	S	I	34x 32	15.9	0.44	4803	323	353	6.30	6.9	0.3	6.3		
WKK2844+		M	14 01 41.0	-53 25 14	313.39	8.02	I		30x 15	17.4	0.46	>3802	...	...	...	4.6				
WKK2850		M	14 01 56.4	-55 47 30	312.78	5.73	S	L	38x 24	16.5	0.46	3968	270	288	18.02	4.9				
WKK2863+	ESO174-G005	MI	14 02 13.7	-53 32 28	313.44	7.88	S	5	98x 83	14.2	0.47	3802:	308:	333:	15.28:	4.6	*	8.7	38.8	
WKK2903		M	14 04 39.6	-69 04 13	309.42	-7.13	S	6	114x 12	15.9	0.29	3015	270	289	10.71	3.0				
WKK2924+		M	14 05 13.4	-65 34 30	310.47	-3.79	S	8:	58x 22	16.1	0.60	3410	205	218	2.12	2.5				
WKK2938+		M	14 05 45.0	-65 41 04	310.49	-3.91	L		34x 22	16.3	0.56	2864	128	173	2.58:	2.5	7.3	5.0		
WKK2993	ESO175-G003	MI	14 08 41.1	-55 14 06	313.86	5.99	S	M	62x 28	15.8	0.45	4347	254	295	18.51	2.9				
WKK3002?+		M	14 09 17.1	-55 32 13	313.85	5.68	S	L?	56x 20	16.5	0.50	3436	91	120	3.59	4.8	n			
WKK3006?+		M	14 09 46.4	-55 39 16	313.88	5.54			13x 8	19.1	0.50	2820	78	95	1.99:	4.8	n	4.6		
WKK3045	ESO175-G004	I	14 12 32.8	-56 34 33	313.97	4.55	S	L	116x 56	14.5	0.66	3776	293	334	6.48	3.4				
WKK3068		M	14 14 12.7	-53 55 18	315.03	6.99	S	L	60x 27	16.1	0.67	5501	355	385	8.42	5.9				
WKK3069		M	14 14 19.7	-56 41 31	314.17	4.36	?I		74x 27	15.8	0.76	3995	168	203	7.56	4.0				
WKK3107	ESO175-G005	MI	14 17 46.9	-52 49 48	315.90	7.85	S	L	120x 19	15.6	0.47	3088	287	309	14.72	5.3				
WKK3139		I	14 20 23.0	-55 04 06	315.51	5.62	S	R	43x 26	15.8	0.60	2826	216	241	12.21	5.5	0.4	12.2		
WKK3191		I	14 26 30.9	-54 21 59	316.59	5.96	S	L	62x 19	16.3	0.77	3192	220	251	19.59	4.8				
WKK3221		M	14 28 59.3	-54 45 01	316.78	5.48	S	5	54x 43	15.6	0.64	4902	192	218	3.11	2.9				
WKK3278	ESO067-G002	M	14 37 03.3	-70 28 51	311.59	-9.41	S	6	74x 17	16.1	0.29	2918	160	183	2.95	2.6				
WKK3285		M	14 36 48.1	-53 34 23	318.30	6.13	I	?	24x 17	17.7	0.81	3010	125:	185:	3.12:	2.9	20.1	453.1		
WKK3323		MI	14 39 27.9	-55 25 04	317.91	4.28	S	D?	54x 39	15.6	0.71	4628	337	362	5.90	2.8				
WKK3503		M	14 56 56.0	-67 09 29	314.69	-7.20	S	6	51x 24	16.3	0.31	4423	139	242	7.56	4.4				
WKK3672	ESO067-G007	M	15 06 27.6	-69 21 27	314.39	-9.55	S	7	74x 17	16.1	0.16	5019	205	222	2.14	2.3				
WKK3880	ESO221-G028	M	14 09 02.2	-51 10 07	315.14	9.86	S	5	73x 56	15.0	0.39	4533	140	166	11.05:	7.6	3.7	13.1	3650/4700	

Table 1. continued.

Ident.	Other	IR	RA (h m s)	Dec (deg ' ")	gal $\ell$ (deg)	gal $b$ (deg)	Type	$D \times d$ (")	$B_J$ ( $m$ )	$E_{(B-V)}$ ( $m$ )	$V_{\text{hel}}$ $\text{km s}^{-1}$	$\Delta V_{50}$ $\text{km s}^{-1}$	$\Delta V_{20}$ $\text{km s}^{-1}$	$I$ $\text{Jy km s}^{-1}$	rms hann $\text{mJy}$	$N$	dist ( $'$ )	$I_c$ $\text{Jy km s}^{-1}$	excised RFI $\text{km s}^{-1}$	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
WKK4016+	ESO222-G008		14 29 37.3	-51 54 60	317.93	8.07	S	67 $\times$ 48	15.5	0.37	4641:	109:	295:	...	7.0	*	12.1	...	4100	
WKK4022+			14 30 20.4	-51 47 26	318.08	8.15	S	91 $\times$ 34	15.7	0.38	4621:	179:	232:	12.48:	7.0		2.2	13.2	4100	
WKK4171			14 42 18.5	-54 05 32	318.83	5.32	S	7 106 $\times$ 16	16.3	0.70	2779	183	206	5.39	4.0				2050	
WKK4231	ESO222-G015		14 44 27.2	-49 23 59	321.13	9.44	SY	5: 159 $\times$ 60	14.2	0.21	2306	221	237	10.64:	6.3		5.4			
WKK4272	ESO176-G003		14 46 11.0	-53 17 43	319.69	5.80	S	5 66 $\times$ 17	16.4	0.64	4914	258	293	5.73	2.4					
WKK4338		M	14 48 55.6	-55 38 49	319.03	3.51	S	5: 51 $\times$ 17	16.5	0.80	5655	420	465	5.00	1.7					
WKK4470	ESO176-G006	MI	14 57 09.9	-54 23 31	320.65	4.10	S	87 $\times$ 23	15.6	0.85	2879	476	499	23.30	4.3					
WKK4482		MI	14 57 49.6	-51 58 16	321.88	6.19	S	60 $\times$ 24	16.1	0.60	4159	546:	564:	5.48:	3.2		2.1	5.8	4350	
WKK4486	HIZOAJ1458-55	MI	14 58 14.3	-55 11 37	320.42	3.31	S	79 $\times$ 38	15.4	0.88	5223	207	268	8.44	4.8					
WKK4585	ESO176-G008	M	15 03 48.7	-53 09 14	322.11	4.72	S	6 114 $\times$ 20	15.7	0.70	4717	490	516	8.31	2.7					
WKK4748	HIZSS096	I	15 14 34.4	-52 59 20	323.59	4.04	S	5 212 $\times$ 56	13.9	0.99	1449	445	470	152.2	8.0		0.2	152.3		
WKK4760			15 15 58.5	-61 03 46	319.53	-2.94	S	28 $\times$ 13	16.8	1.34	4739	118	212	3.13	3.2					
WKK5229	HIZOAJ1543-60		15 43 28.0	-60 16 11	322.76	-4.20	S	58 $\times$ 19	15.8	0.74	5187	235	266	8.88	3.2					
WKK5240	ESO099-G008	I	15 45 11.3	-66 17 32	319.19	-9.07	S	157 $\times$ 13	15.1	0.14	4785:	297:	372:	4.26:	2.0		11.7	23.0		
WKK5253		MI	15 45 26.9	-60 59 31	322.51	-4.92	S	47 $\times$ 19	15.9	0.71	5261	377	405	9.45	5.0		0.3	9.5		
WKK5260	ESO099-G009		15 46 01.4	-63 18 44	321.12	-6.79	S	82 $\times$ 20	15.4	0.26	4657	293	309	8.93	6.0				4950	
WKK5266	ESO136-G002	M	15 46 23.7	-62 11 24	321.85	-5.93	S	90 $\times$ 22	15.0	0.37	4939	297	321	10.17	3.1					
WKK5285	HIZOAJ1547-59	I	15 47 10.8	-59 04 07	323.87	-3.54	S	19 $\times$ 12	17.1	0.63	5635	339	357	14.21:	3.5		2.7	15.5		
WKK5299			15 48 04.5	-63 37 13	321.11	-7.17	S	70 $\times$ 12	16.2	0.27	4402:	189:	209:	4.97:	3.1	*				
WKK5366?	HIZOAJ1550-58	M	15 50 22.6	-58 22 36	324.63	-3.26	S	5 43 $\times$ 15	16.4	0.78	2064	115	139	5.40	4.2					
WKK5378			15 51 01.0	-59 30 41	323.97	-4.19	S	23 $\times$ 12	17.1	0.52	5016	153	220	10.05	5.1					
WKK5404	ESO100-G001	MI	15 52 19.4	-62 48 38	322.00	-6.84	S	71 $\times$ 20	15.3	0.27	6404	407	462	8.47	4.1				5850/6250	
WKK5413		M	15 52 29.9	-60 38 07	323.41	-5.18	S	2 47 $\times$ 12	16.0	0.42	6106	164	178	1.87	3.3					
WKK5416		DI	15 52 33.7	-58 23 37	324.84	-3.45	? ?	24 $\times$ 9	17.4	0.74	5580	424	474	6.57	5.0		0.9	6.6		
WKK5430		M	15 53 18.8	-61 08 13	323.16	-5.63	SB	36 $\times$ 23	16.1	0.40	4350	262	282	17.32	4.7					
WKK5443OFF	HIZSS100		15 43 10	-58 44 24:	323.66	-2.96				1.19	2907	147	161	9.14:	7.5		1.7	9.5		
WKK5456	ESO136-G007	M	15 54 14.2	-59 49 55	324.09	-4.70	S	77 $\times$ 30	15.0	0.49	5590	292	319	8.22	3.4					
WKK5459	ESO136-G008	MI	15 54 22.9	-61 20 24	323.13	-5.87	S	3 78 $\times$ 32	14.5	0.40	4388	398	432	13.17:	3.3		6.3	21.5		
WKK5470		M	15 54 44.7	-60 56 06	323.43	-5.58	S	5 38 $\times$ 26	15.8	0.48	5120	369	400	5.56	3.6				4300/4500/4750	
WKK5562+		M	15 57 52.7	-61 02 53	323.64	-5.91	S	67 $\times$ 26	15.5	0.42	4443	228	249	4.81	2.9					
WKK5584	ESO136-G010	M	15 58 29.4	-60 17 43	324.19	-5.39	SY	5 73 $\times$ 43	14.6	0.36	4936	269	288	7.32:	4.4				4850	
WKK5616+			15 59 27.3	-61 07 03	323.74	-6.09	S	19 $\times$ 5	18.4	0.41	4167	41	55	1.95:	5.1	n	5.3	2.8		
WKK5636		M	16 00 04.0	-61 21 51	323.64	-6.33	S	32 $\times$ 30	15.9	0.36	5866	93	117	5.97	3.2	*				
WKK5642?++		MI	16 00 10.8	-61 06 54	323.81	-6.15	S	48 $\times$ 17	15.9	0.40	6446	122	222	2.72	3.6					
WKK5659?++		M	16 00 38.0	-61 06 03	323.86	-6.17	S	6 44 $\times$ 15	16.3	0.38	4418	146	157	2.22:	3.4					
IC4584+	ESO100-G004	I	16 00 13.7	-66 22 42	320.31	-10.11	SAS7	102 $\times$ 90	15.8N	0.11	3671:	330:	377:	9.76:	3.4		9.4	29.0		
IC4585+	ESO100-G005	MI	16 00 17.6	-66 19 20	320.35	-10.07	SY55	126 $\times$ 36	13.0R	0.11	3671:	330:	377:	9.76:	3.4		8.6	24.3		
WKK5729+		M	16 02 47.6	-61 03 14	324.09	-6.31	S	48 $\times$ 16	16.3	0.32	>5729	...	...	...	...		6.9	...		
WKK5760	ESO136-208	M	16 03 29.2	-59 39 47	325.08	-5.33	SY	5 116 $\times$ 27	14.7	0.35	5149	374	392	8.17	3.4					
WKK5768	ESO136-G016	M	16 03 49.2	-60 58 41	324.23	-6.34	S	5 211 $\times$ 26	14.0	0.32	5422	524:	541:	6.18:	2.9		9.5	18.8		
WKK5796	ESO136-G017	M	16 04 25.0	-60 44 14	324.45	-6.20	S	0: 109 $\times$ 22	14.6	0.32	5372	100	119	1.94:	5.2		2.8	2.1	4300	

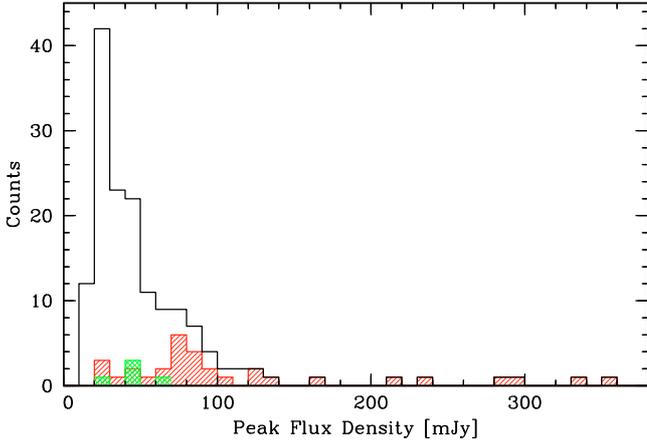
Table 1. continued.

Ident.	Other	IR	RA (h m s)	Dec (deg ' ")	gal $l$ (deg)	gal $b$ (deg)	Type	$D \times d$ (")	$B_J$ ( $m$ )	$E_{(a-v)}$ ( $m$ )	$V_{hel}$ $km\ s^{-1}$	$\Delta V_{50}$ $km\ s^{-1}$	$\Delta V_{20}$ $km\ s^{-1}$	$I$ $Jy\ km\ s^{-1}$	rms hann $mJy$	$N$	dist ( $^{\circ}$ )	$I_c$ $Jy\ km\ s^{-1}$	excised RFI $km\ s^{-1}$	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
WKK5829			16 05 34.8	-61 15 28	324.21	-6.69	S	L	91 $\times$ 12	15.6	0.25	4409	167:	9.58	7.2	n	*			
WKK5882		M	16 06 27.4	-57 33 52	326.78	-4.02	S	5	60 $\times$ 16	16.3	0.58	5056	401	9.83	3.6					
WKK5891		I	16 07 04.2	-61 27 56	324.20	-6.96	S	L	65 $\times$ 34	15.0	0.25	5255	141	2.48	2.5					
WKK5904	ESO100-G010		16 07 39.5	-63 57 36	322.54	-8.84	SY	5:	65 $\times$ 35	15.1	0.18	7403	264	7.15	4.0					6850
WKK5933+	ESO136-G019	M	16 09 50.4	-60 11 27	325.32	-6.25	S	L	90 $\times$ 32	14.7	0.25	3443:	235:	4.30:	2.3	*				
WKK5999	ESO136-G020	M	16 09 56.0	-60 19 18	325.24	-6.36	SYR5	6 $\times$ 54	14.2	0.25	3244	176	195	21.33:	7.0					3250
WKK6100		M	16 11 55.8	-60 43 33	325.14	-6.82	S	P	34 $\times$ 28	15.7	0.21	5011	91	100	0.97	3.3	n	5.7	1.4	
WKK6181	ESO100-G013	MI	16 13 44.5	-63 24 26	323.42	-8.90	S	E	60 $\times$ 20	15.0	0.14	3331	258	289	6.05	4.4		0.1	6.1	
WKK6219			16 13 46.0	-56 16 25	328.39	-3.75	S		32 $\times$ 24	16.5	0.60	2627	108	136	3.94	4.8				3200
WKK6331		I	16 16 14.4	-61 50 49	324.73	-7.98	I	9	43 $\times$ 15	16.4	0.18	4376	161	184	2.69	1.8				
WKK6353	ESO100-G015		16 16 35.0	-62 41 26	324.16	-8.61	S	5	70 $\times$ 16	15.8	0.14	9753	438	460	5.27:	3.0				9700/10150
WKK6483	ESO100-G018	MI	16 19 01.2	-63 03 11	324.10	-9.07	S	7	85 $\times$ 66	13.9	0.14	3273	149	184	5.34	4.1				
WKK65357+		M	16 20 08.6	-63 28 13	323.89	-9.45	S	5	39 $\times$ 9	17.2	0.14	4159	183	230	3.68:	3.1		6.5	6.2	
WKK65707+		M	16 20 40.1	-63 22 45	324.00	-9.43	SY	3	60 $\times$ 27	15.5	0.15	2938	148	192	2.42	1.8				3300
WKK6594	ESO137-G018	MI	16 20 59.2	-60 29 13	326.11	-7.43	S	7	239 $\times$ 82	12.6	0.25	605	141	164	45.55	3.6				
WKK6680			16 22 46.0	-62 50 05	324.56	-9.22	S	7	46 $\times$ 34	15.5	0.20	6462	74	90	1.22	5.4	n	*		
WKK6689+	ESO137-G020		16 22 47.6	-60 18 56	326.39	-7.46	SB	5	82 $\times$ 60	14.2	0.24	3184:	136:	176:	4.86:	2.6				
WKK6732			16 23 36.1	-60 11 29	326.55	-7.45	SB	5	44 $\times$ 36	15.5	0.23	3226	93	112	5.23:	5.5	n			
WKK6872			16 27 21.3	-60 27 22	326.68	-7.97	I	9:	109 $\times$ 62	14.1	0.20	1155	91	108	24.64	5.9	n			
WKK6913			16 28 36.0	-59 56 50	327.16	-7.73	I		30 $\times$ 27	16.2	0.23	5540	130	144	2.90:	4.1	3.2	3.3		
WKK6993			16 30 06.3	-57 41 16	328.96	-6.33	S	L	99 $\times$ 38	14.7	0.45	2683	219	238	10.50	4.5				3050
WKK7149	NGC6159	MI	16 34 52.2	-60 37 06	327.19	-8.76	S	4	98 $\times$ 83	13.2	0.17	3275	145	235	23.39	7.1				
WKK7198	CSRG0806	MI	16 36 51.9	-60 16 36	327.61	-8.71	S	R5	91 $\times$ 70	14.0	0.23	3407	250	267	12.12	8.0				
WKK7287+			16 40 51.4	-60 20 23	327.89	-9.13	I		30 $\times$ 20	16.5	0.25	5740	66	74	1.14:	4.7				4750/5900
WKK7289+	ESO137-G038	MI	16 40 52.5	-60 23 40	327.85	-9.17	SYR5	191 $\times$ 73	13.1	0.25	5278	435	454	12.19	4.7					4750/5900
WKK7293	ESO137-G039		16 41 06.7	-60 58 55	327.42	-9.57	S	7	69 $\times$ 11	16.2	0.26	3502	174	210	5.24	3.6				3200
WKK7294			16 40 52.7	-56 24 21	330.90	-6.56	S	5	79 $\times$ 19	15.4	0.29	5013	301	321	4.12	2.0				
WKK7328	FGCE 1256	MI	16 42 49.6	-61 05 25	327.47	-9.80	S	6	126 $\times$ 17	15.2	0.30	4485	328	402	5.69	2.6				
WKK7377	ESO179-G012	M	16 44 21.6	-55 29 39	331.92	-6.33	S	L	145 $\times$ 20	14.7	0.35	5117	450	481	25.45	3.5				
WKK7460+	ESO179-G013	MI	16 47 20.0	-57 26 28	330.68	-7.90	SY	L	198 $\times$ 105	12.7	0.27	842:	179:	222:	113.8:	3.7	1.4	116.6		
WKK7463+			16 47 27.8	-57 25 36	330.70	-7.90	S		82 $\times$ 67	14.3	0.28	842:	...	...	...	3.7				
WKK7465+	ESO137-G042	I	16 47 40.5	-60 08 58	328.59	-9.66	S	4	112 $\times$ 66	13.6	0.19	> 3256	...	...	...	5.9				
WKK7652	NGC6221	I	16 52 46.0	-59 13 07	329.74	-9.57	SY	3	302 $\times$ 179	11.2	0.16	1519	300	340	26.43:	6.3	11.6	138.7		
WKK7776		M	16 57 29.7	-58 34 27	330.63	-9.66	SY	5	130 $\times$ 95	13.6	0.18	2791	49	67	15.71	7.8	n			
WKK7863			17 02 31.6	-52 50 24	335.67	-6.74	S		74 $\times$ 54	14.6	0.38	4436	134	169	10.05	3.4				
WKK7949	ESO180-G003		17 08 36.1	-56 35 11	333.15	-9.67	S	4	65 $\times$ 56	14.6	0.18	4677	113	137	4.70	3.1				
Y395-4	ESO395-G004	MI	18 24 23.3	-34 10 55	359.40	-9.76	S		72 $\times$ 42	15.8N	0.13	4904	324	352	7.02	3.1	0.1	7.0	4350	

Notes: WKK0969: see plot of WKK1117; WKK2576: the signal is blended with WKK2595 and WKK2597 (cf. text), the width and velocity of the narrow peak are given here; WKK2597: see plot of WKK2863; see plot of WKK2844; WKK4016: the signal is blended with WKK4022, the velocity measurements refer to the narrow peak at  $v=4640\ km\ s^{-1}$  only; WKK5299: the parameters are uncertain due to an RFI at the edge of the profile at  $v=4500\ km\ s^{-1}$ ; WKK5616: see plot of WKK5659; WKK5636: Hanning-smoothed once despite the narrow line, due to ringing in the spectrum; WKK5829: not Hanning-smoothed due to an RFI close to the profile at  $v=4550\ km\ s^{-1}$ ; WKK5993: the profile of WKK5999 (see separate pointing) has been excluded from the profile measurement; WKK6680: once Hanning-smoothed for the plot.

Table 2. Comparison of velocities.

Ident.	$V_{\text{hel}}$ km s <sup>-1</sup>	$V_{\text{other}}$ km s <sup>-1</sup>	origin	Reference	Ident.	$V_{\text{hel}}$ km s <sup>-1</sup>	$V_{\text{other}}$ km s <sup>-1</sup>	origin	Reference
(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
WKK0204	4349	4332 ± 8	HI	HIPASS	WKK3880	4533	4572 ± 85	opt	RS06
WKK0207	9290	9178 ± 70	opt	VY96	WKK4231	2306	2254 ± 10	opt & HI	CF97
WKK0304	3813	3807 ± 7	HI	HIPASS			2303 ± 6	HI	HIPASS
WKK0491	7353	7523 ± 250	opt	FW98	WKK4272	4914	4940 ± 9	HI	HIPASS
WKK0539	7562	7651 ± 85	opt	RS06	WKK4470	2879	2875 ± 10	HI	HIZSS
		7534 ± 8	HI	HIPASS			2877 ± 10	HI	HIZOA
WKK0662	5603	6526 ± 231	opt	FW98			2890 ± 6	HI	HIPASS
		5760 ± 76	opt	WK04	WKK4486	5223	5200 ± 10	HI	HIZOA
		5630 ± 85	opt	RS06	WKK4585	4717	4728 ± 137	opt	WK99
WKK1045	5411	5268 ± 250	opt	FW98	WKK4748	1449	1449 ± 10	HI	HIZSS
WKK1089	1712	3939 ± 150	opt	FW98			1445 ± 10	HI	HIZOA
		1714 ± 5	HI	HIPASS			1456 ± 3	HI	HIPASS-BGC
WKK1294	1919	1910 ± 10	opt & HI	CF97			1456 ± 5	HI	HIPASS
WKK1352	5437	5528 ± 100	opt	FW98	WKK5229	5187	5193 ± 10	HI	HIZOA
WKK1446	3677	3679 ± 9	HI	HIPASS	WKK5240	4785:	4787 ± 8	HI	HIPASS
WKK1455	3692	3684 ± 100	opt	WK04	WKK5253	5261	5093 ± 70	opt	VY96
WKK1972	5651	5630 ± 85	opt	RS06	WKK5260	4657	4963	opt	D91
WKK2029	2349	2355 ± 50	opt	FW98			4740 ± 10	HI	HIPASS
		2337 ± 10	HI	HIZSS	WKK5266	4939	4944	HI	MH91
		2340 ± 5	HI	HIPASS			4940 ± 7	HI	HIPASS
WKK2147	4180	4153 ± 44	opt	FH95	WKK5285	5635	5631 ± 30	HI	HIZOA
WKK2171	3709	3633 ± 10	HI	HIPASS	WKK5366?	2064	2059 ± 10	HI	HIZOA
WKK2172	4029	4069 ± 11	HI	HIPASS			4822 ± 82	opt	WK04
WKK2222	2582	2570 ± 7	HI	HIPASS	WKK5404	6404	6450 ± 70	opt	DN97
WKK2245	2912:	2915 ± 10	HI	HIZSS	WKK5413	6106	6057 ± 174	opt	WK99
		2903 ± 10	HI	HIZOA	WKK5416	5580	5524 ± 114	opt	WK04
		2992 ± 85	opt	RS06			12403 ± 70	opt	VY96
WKK2254	5518	5653 ± 58	opt	FW06	WKK5443OFF	2907	2905 ± 10	HI	HIZSS
WKK2372	4058	4058 ± 3	HI	HK01			2897 ± 10	HI	HIZOA
WKK2388	3938	3976 ± 40	opt	FH95	WKK5459	4388	4390 ± 60	opt	RC3
WKK2390	3659:	3790 ± 70	opt	VY96			4396 ± 7	HI	HIPASS
		3586 ± 10	HI	HIPASS	WKK5470	5120	5209 ± 214	opt	WK99
WKK2392	3659:	3790 ± 70	opt	VY96	WKK5584	4936	5027	opt	D91
WKK2402	3947	3956 ± 6	HI	HIPASS	WKK5642?	6446	6045 ± 42	opt	SH92
WKK2433	5335	5367 ± 53	opt	FH95			6118 ± 100	opt	WK04
WKK2503?	2794:	2789 ± 10	HI	HIZSS	IC4584	3671:	3700 ± 44	opt	SH92
		2769 ± 10	HI	HIZOA	IC4585	3671:	3638 ± 40	opt	RC3
		2774 ± 6	HI	HIPASS	WKK5768	5422	5426 ± 10	HI	RC3
WKK2542	684	694 ± 6	HI	HK01			5428 ± 6	HI	HIPASS
		680	HI	BD99	WKK5796	5372	5260 ± 60	opt	RC3
		688 ± 3	HI	HIPASS-BGC	WKK5993	3443:	3487 ± 108	opt	WK04
		687 ± 5	HI	HIPASS	WKK5999	3244	3250 ± 38	opt	WK04
WKK2576	3883:	3948 ± 70	opt	DN97			3246 ± 6	HI	HIPASS
		3876 ± 85	opt	RS06	WKK6181	3331	3278 ± 70	opt	VY96
		3872 ± 5	HI	HIPASS			3308 ± 70	opt	WK99
WKK2595	3886:	3873 ± 85	opt	RS06	WKK6353	9753	9900 ± 70	opt	DN97
WKK2596	3867	3869 ± 10	HI	HIZSS	WKK6483	3273	3367	opt	D91
		3848 ± 10	HI	HIZOA			3268 ± 17	HI	HIPASS
		3881 ± 7	HI	HIPASS	WKK6594	605	606 ± 20	opt	HG95
WKK2597	3886:	3973 ± 43	opt	SH92			605 ± 3	HI	HIPASS-BGC
		3954 ± 85	opt	RS06			605 ± 5	HI	HIPASS
WKK2640	3705	3574 ± 85	opt	RS06	WKK6689	3184:	3239 ± 88	opt	WK04
WKK2644	9404	9406 ± 100	opt	WK04	WKK6872	1155	1157 ± 3	HI	HIPASS-BGC
		9276 ± 85	opt	RS06			1157 ± 5	HI	HIPASS
WKK2670	3821	3758 ± 40	opt	FH95	WKK7149	3275	3300 ± 30	opt	SE95
		3798 ± 85	opt	RS06			3263 ± 6	HI	HIPASS
WKK2693	7081	7389 ± 250	opt	FW98	WKK7198	3407	3405 ± 6	HI	HIPASS
		7013 ± 80	opt	WK04	WKK7289	5278	2100 ± 100	opt	F83
WKK2804	4803	4779 ± 39	opt	FH95	WKK7377	5127	5122 ± 7	HI	HIPASS
WKK2850	3968	3959 ± 6	HI	HIPASS	WKK7460	842:	775 ± 36	opt	SH92
WKK2863	3802:	3775 ± 37	opt	SH92			842 ± 4	HI	HIPASS-BGC
		3778 ± 30	opt	SE95			843 ± 5	HI	HIPASS
		3768 ± 6	HI	HIPASS	WKK7465	>3256	3255 ± 39	opt	SH92
WKK2938	2864	3024 ± 157	opt	FW98			3265 ± 4	HI	DN96
WKK2993	4347	4313 ± 37	opt	FH95			3283 ± 85	opt	RS06
		4364 ± 45	opt	FW98	WKK7652	1519	1350 ± 31	opt	RC3
		4345 ± 7	HI	HIPASS			1478 ± 38	opt	WK04
WKK3107	3088	3090 ± 7	HI	HIPASS			1340 ± 85	opt	RS06
WKK3139	2826	2844 ± 70	opt	VY96			1499 ± 5	HI	HIPASS
		2823 ± 7	HI	HIPASS	WKK7776	2791	2790 ± 3	HI	HIPASS-BGC
WKK3191	3192	3187 ± 6	HI	HIPASS			2790 ± 5	HI	HIPASS
WKK3278	2918	3118 ± 40	opt	FW98	Y395-4	4904	4896 ± 43	opt	FH95
WKK3285	3010	3016	HI	RK02			4895 ± 9	HI	TH07
		3016 ± 3	HI	HIPASS-BGC					
		3017 ± 5	HI	HIPASS					



**Fig. 2.** Histogram of peak flux density in mJy of our detections (open) and of the detections in common with HIPASS (hashed). Cross-hatched detections are HIPASS detections with errors  $\geq 10$  km s $^{-1}$ . Note that there are three more detections by both surveys beyond the frame of the plot between 400 mJy and 800 mJy.

with HIPASS confirms that corrections for distances up to half the beam width (i.e., 7.5) are acceptable.

#### 4. The non-detections

A further 152 galaxies that were observed in the Crux and GA regions were not detected. They are listed in Table 4 with the searched velocity range as well as the rms within that interval. Some spectra did reveal a signal, but careful investigation showed them to be due to close neighbours rather than the targeted galaxies. These cases are marked with a plus in Col. 1 of Table 4 (see also Table 1), and the identification of the signal is given in the footnote. Some of these cases are discussed in detail in Appendix A.

*Columns 1–11:* same as in Table 1. CGMW4# in Col. 2 stands for the 4th Catalog of Galaxies Behind the Milky Way (Roman et al. 2000).

*Column 12:* the searched velocity range in km s $^{-1}$ .

*Column 13:* the rms noise of the searched velocity range in mJy, typically of the order of 4 mJy. These values were determined after baseline fitting over a width of 1600 km s $^{-1}$  – hence similar to the determination for detections – centred at increasingly higher redshifts in order to obtain values for the whole velocity range. The quoted values represent the highest rms for the velocity intervals, the rms for the nearer velocities are on average slightly lower.

*Column 14:* perturbed velocity intervals, mainly due to recurring RFI around 800, 1250 and  $\sim 7400$  km s $^{-1}$ , very strong GPS (Global Positioning System) signals around 8300–8500 km s $^{-1}$ , and detections of other galaxies. In these intervals a signal would have gone undetected.

*Column 15:* a star indicates a footnote for this entry.

*Column 16:* the distance in arcminutes of the targeted galaxy to the centre of the beam. Given the falloff of sensitivity with distance from the centre of the beam, any upper limits for flux densities calculated from the rms of such cases are underestimated.

*Columns 17–19:* independent velocity determinations and error for the non-detected galaxies. The reference coding (Col. 18) is as in Table 3, and Col. 19 gives the origin of the measurement (optical or HI).

**Table 3.** References for independent velocity determinations.

BD99:	Banks et al. (1999)
CF97:	Coté et al. (1997)
DN96:	Di Nella et al. (1996)
DN97:	Di Nella et al. (1997)
DT90:	Djorgovski et al. (1990)
D91:	Dressler (1991)
F83:	Fairall (1983)
FW98:	Fairall et al. (1998)
FW06:	Fairall & Woudt (2006)
FH95:	Fisher et al. (1995)
HW00:	Hasegawa et al. (2000)
HIZSS:	Henning et al. (2000)
HIPASS:	HIPASS (2006)
HG95:	Huchra et al. (1995)
HK01:	Huchtmeier et al. (2001)
JS00:	Juraszek et al. (2000)
KD04:	Koribalski & Dickey (2004)
HIPASS-BGC	Koribalski et al. (2004)
MF96:	Mathewson & Ford (1996)
MH91:	Mould et al. (1991)
PT03:	Patrel et al. (2003)
RS06:	Radburn-Smith et al. (2006)
RK02:	Ryan-Weber et al. (2002)
SE95:	Sanders et al. (1995)
SH92:	Strauss et al. (1992)
TH07:	Theureau et al. (2007)
RC3:	de Vaucouleurs et al. (1991)
Vv92:	Visvanathan & van den Bergh (1992)
VY96:	Visvanathan & Yamada (1996)
WK99:	Woudt et al. (1999)
WK04:	Woudt et al. (2004)

Based on this table, only 42% of the 149 pointings have an unperturbed velocity range, and 52% of the pointings are RFI free (i.e., 18 pointings are affected by the detection of a galaxy, either in the ON or in the OFF scan). Table 5 lists the frequencies of the noted velocity ranges affected by RFIs which affect the possible detection of a galaxy. Note that the single 10-min scans show many more RFIs, most of which, however, could be excised successfully. The worst affected velocity ranges are either very low (800–1350 km s $^{-1}$  for 23% of pointings) or around 8300–8500 km s $^{-1}$  for 14% of the cases. In 8% of the cases the velocity range 7000–7700 km s $^{-1}$  shows some problems.

WKK 3836 is the only galaxy that we have not detected but was subsequently detected by HIPASS. On the one hand, our rms of 7 mJy is fairly high (only 13% of our detection have an rms of 7 mJy and higher) and the pointing is  $d = 8.5$  away from the galaxy position (which means the signal would be reduced by a factor of 2.4). On the other hand, the HIPASS detection is weak (the peak flux density is 37 mJy and the error on the velocity at 12 km s $^{-1}$  is the second highest value in our sample of HIPASS galaxies).

#### 5. Velocity distribution and detection rate

Figure 3 shows the Crux/GA search area (outlined regions) in Galactic coordinates with the optically discovered galaxies ( $D \lesssim 0^m.2$ ) plotted as small dots (Woudt & Kraan-Korteweg 2001). The 314 galaxies observed with the Parkes radio telescope (indicated with larger symbols) are distributed fairly homogeneously over the galaxy density distribution – leading naturally to a larger number of observations in the high density area

Table 4. HI non-detections in the Crux and Great Attractor region.

Ident.	Other	IR	RA (h m s)	Dec (deg ' ")	gal $\ell$ (deg)	gal $b$ (deg)	Type	$D \times d$ (")	$B_J$ ( $m$ )	$E_{(B-V)}$ ( $m$ )	$V_{\text{obs}}$ range $\text{km s}^{-1}$	rms mJy	$V_{\text{range}}^{\text{pert}}$ $\text{km s}^{-1}$	$N$	dist (')	$V_{\text{other}}$ $\text{km s}^{-1}$	Ref	origin			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)			
WKK0199			11 07 24.8	-70 22 40	294.35	-9.26	SY 5	58 × 30	15.9	0.23	600 – 5800	4.8									
WKK0331	ESO063-G019	M	11 44 00.8	-68 21 35	296.76	-6.30	S 5	73 × 23	16.0	0.35	600 – 13600	4.4				12565 ± 250	FW98	opt			
WKK0338	ESO064-G001	M	11 45 09.1	-71 50 27	297.76	-9.64	S 4	70 × 23	16.0	0.30	500 – 13350	4.1				7313 ± 100	FW98	opt			
WKK0411	ESO171-G002	I	11 54 15.3	-54 09 39	294.54	7.78	S R	60 × 40	15.6	0.27	600 – 13600	3.6	7500 – 7750			5359 ± 77	VY92	opt			
WKK0425		M	11 55 15.5	-55 20 28	294.94	6.66	SB 5	42 × 38	16.3	0.27	700 – 10450	3.6									
WKK0428		I	11 55 24.9	-56 54 58	295.31	5.12	?	54 × 16	16.8	0.44	500 – 10450	2.5	1150 – 1300								
WKK0585	ESO171-G006	M	12 04 28.0	-53 56 09	295.98	8.30	S 5	87 × 11	16.3	0.20	700 – 10350	3.1				8382 ± 134	WK04	opt			
Y217- 21	ESO217-G021	MI	12 04 43.7	-52 28 49	295.75	9.74	S 4	63 × 9	17.5L	0.14	450 – 10450	3.0	7400 – 8750			8112 ± 85	RS06	opt			
WKK0633		M	12 06 37.6	-68 18 44	298.79	-5.80	S 5	40 × 5	18.1	0.35	3950 – 11100	4.6				8074 ± 39	FW95	opt			
WKK0975		M	12 23 48.8	-59 56 41	299.48	2.74	S 5	43 × 7	18.3	1.22	600 – 5700	4.4				7963 ± 85	RS06	opt			
WKK1584		M	12 57 51.2	-56 01 18	303.83	6.84	S 3	40 × 9	17.3	0.35	600 – 5700	4.2									
WKK1597		M	12 58 38.9	-71 35 09	303.51	-8.72	S	56 × 9	17.6	0.30	5000 – 10450	3.0	8100 – 8950			5957 ± 85	RS06	opt			
WKK1694+	ESO173-G002	MI	13 02 22.9	-56 17 35	304.46	6.55	S 4:	78 × 17	16.1	0.33	600 – 10350	3.1	6350 – 6700	*							
WKK1707		M	13 02 57.6	-66 03 50	304.10	-3.22	S	26 × 11	17.5	0.79	450 – 10350	3.9									
WKK1806		M	13 07 00.4	-67 19 23	304.44	-4.50	S	54 × 24	16.3	0.53	600 – 10000	3.7	10000 – 10350		0.1	7730 ± 30	WK04	opt			
WKK1822	ESO173-G006	MI	13 07 17.9	-54 07 35	305.28	8.67	S R5	60 × 30	15.9	0.38	400 – 13600	5.3				8016 ± 70	VY96	opt			
WKK1827	ESO065-G005	M	13 07 52.5	-71 55 17	304.22	-9.09	S 6	51 × 38	16.2	0.29	400 – 10250	3.1	6950 – 7200			7777 ± 85	RS06	opt			
WKK1883		MI	13 09 30.4	-57 28 16	305.37	5.32	S 3	32 × 12	17.3	0.46	400 – 5700	3.4	8200 – 8750		2.2	6801 ± 70	VY96	opt			
WKK1884			13 09 59.3	-71 44 07	304.40	-8.92	SB 5	51 × 40	16.2	0.30	600 – 10450	3.8	6950 – 7350			5657 ± 38	WK04	opt			
WKK1888			13 09 44.8	-57 52 43	305.37	4.91	S	40 × 22	16.6	0.44	600 – 10250	3.9	9250 – 9450			5666 ± 85	RS06	opt			
WKK1891		M	13 10 24.4	-72 01 37	304.41	-9.21	S L	54 × 8	17.9	0.25	350 – 10450	4.3				6413 ± 146	WK04	opt			
WKK1909			13 10 28.3	-56 18 13	305.59	6.47	S L	51 × 28	16.5	0.59	700 – 10450	3.8									
WKK2042	ESO173-G009	I	13 15 47.3	-56 29 40	306.31	6.22	S L	81 × 30	15.6	0.62	600 – 10450	3.5	10050 – 10250			6012 ± 70	FW06	opt			
WKK2049			13 15 58.5	-57 47 29	306.21	4.92	S 6:	58 × 11	17.2	0.59	700 – 10450	4.1	7150 – 7700								
WKK2060		MI	13 16 28.6	-58 34 55	306.20	4.13	S 7:	50 × 16	16.8	0.85	600 – 9850	4.1	7800 – 8750	*							
WKK2101		I	13 18 50.2	-57 36 09	306.61	5.07	I 9:	47 × 24	16.7	0.75	400 – 10250	3.4	10250 – 12550								
WKK2134			13 21 07.8	-69 00 07	305.60	-6.28	S L	43 × 9	17.8	0.52	600 – 10350	3.7									
WKK2143		M	13 21 46.3	-56 49 23	307.09	5.80	S 4	59 × 11	16.9	0.77	200 – 10250	5.6	800 – 1100			5369 ± 199	FW98	opt			
WKK2296		M	13 31 02.2	-55 09 39	308.61	7.27	S L	58 × 31	15.8	0.47	600 – 10550	4.6									
WKK2300		M	13 31 33.1	-57 50 05	308.27	4.62	S 5	38 × 12	17.0	0.65	100 – 7050	10.7				5897 ± 85	RS06	opt			
WKK2333			13 33 31.8	-55 28 34	308.92	6.91	S 6	55 × 13	17.0	0.50	600 – 10350	5.3									
WKK2337		M	13 33 44.0	-55 14 28	308.98	7.13	I	38 × 20	16.9	0.49	300 – 10350	4.1	800 – 1100								
WKK2376		M	13 36 35.1	-57 19 59	309.02	5.00	S L	60 × 23	16.3	0.68	600 – 10450	3.5	3700 – 3900								
WKK2453			13 40 53.2	-53 15 57	310.38	8.89	S 4	40 × 15	16.7	0.37	400 – 10250	3.2	8200 – 9050								
WKK2493		I	13 44 10.8	-71 16 13	307.18	-8.84	S 2	36 × 30	16.1	0.37	500 – 5600	4.4			0.6	7259 ± 35	FW95	opt			
																			7220 ± 45	FW98	opt

Table 4. continued.

Ident.	Other	IR	RA (h m s)	Dec (deg ' ")	gal $\ell$ (deg)	gal $b$ (deg)	Type	$D \times d$ (")	$B_J$ ( $m$ )	$E_{(g-v)}$ ( $m$ )	$V_{\text{range}}^{\text{obs}}$ km s $^{-1}$	rms mJy	$V_{\text{range}}^{\text{pert}}$ km s $^{-1}$	$N$	dist (')	$V_{\text{other}}$ km s $^{-1}$	Ref	origin	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	
WKK2519	ESO066-G002	M	13 46 26.7	-69 42 26	307.70	-7.35	SB 4	51 $\times$ 28	15.8	0.30	800 – 10550	2.6	7500 – 7900			2071 $\pm$ 250	FW98	opt	
WKK2564			13 49 49.6	-57 37 26	310.71	4.36	S L	43 $\times$ 19	16.7	0.60	1050 – 10250	4.9							
WKK2873			14 03 03.5	-65 31 58	310.26	-3.69		31 $\times$ 11	17.6	0.70	700 – 10350	4.3	1200 – 1350						
											7700 – 8550								
WKK2874		MI	14 02 36.3	-53 05 52	313.62	8.29	S 7:	35 $\times$ 19	16.8	0.49	600 – 5800	4.7		1.1		6000 $\pm$ 70	VY96	opt	
																5819 $\pm$ 85	RS06	opt	
WKK2892		M	14 04 07.6	-52 54 30:	313.89	8.41	S 7	67 $\times$ 38	16.0	0.43	300 – 10350	3.9	3550 – 3800	*	7.5	13844 $\pm$ 85	RS06	opt	
WKK2893		M	14 04 14.4	-71 07 46	308.80	-9.09	S 4	55 $\times$ 19	16.0	0.29	700 – 10450	3.9	7150 – 7450						
WKK2895		M	14 03 56.6	-66 03 03	310.21	-4.21	S	46 $\times$ 9	17.4	0.51	300 – 10250	4.0	900 – 1150						
WKK2958		M	14 06 46.0	-65 06 52	310.75	-3.39	SY	31 $\times$ 17	17.1	0.71	300 – 10250	6.0							
WKK3023		M	14 10 48.3	-60 19 07	312.61	1.05	S E?	43 $\times$ 15	16.6	4.32	500 – 10450	4.4	10050 – 10250						
WKK3041		MI	14 13 08.6	-71 00 21	309.54	-9.19	S P	47 $\times$ 28	16.1	0.34	600 – 9800	4.1	8400 – 8900	1.3		7533 $\pm$ 70	VY96	opt	
																7604 $\pm$ 70	FW98	opt	
WKK3072		MI	14 15 21.8	-67 31 31	310.84	-5.95	S	66 $\times$ 8	17.4	0.46	400 – 10450	4.7	8200 – 8550						
WKK3128+		M	14 19 24.5	-55 13 42	315.32	5.51	S L	56 $\times$ 15	16.7	0.63	600 – 10550	3.6	4150 – 4500	*					
WKK3136		M	14 21 09.2	-71 20 39	310.04	-9.72		54 $\times$ 22	16.3	0.25	600 – 10450	3.8							
WKK3163		M	14 24 29.2	-70 37 27	310.56	-9.14	S L	56 $\times$ 7	17.6	0.32	600 – 10350	3.4	8000 – 8500						
WKK3266		M	14 34 37.0	-52 38 42	318.36	7.11	S 7:	55 $\times$ 9	17.3	0.53	400 – 10450	4.6							
WKK3279		MI	14 36 06.5	-54 24 51	317.87	5.39	S ?	38 $\times$ 12	17.2	0.75	600 – 9800	5.2	3100 – 3350	1.1		3118 $\pm$ 40	FH95	opt	
WKK3296+		M	14 37 31.0	-53 53 25	318.27	5.79	S L	60 $\times$ 24	16.2	0.77	400 – 10400	3.7	2950 – 3200	*					
WKK3346	ESO067-G003	M	14 43 45.3	-70 07 49	312.26	-9.32	S 3:	63 $\times$ 16	16.4	0.26	400 – 10350	3.1	8000 – 8350			5147 $\pm$ 100	FW98	opt	
WKK3357		M	14 44 44.8	-67 34 22	313.44	-7.04	SB 5	56 $\times$ 46	15.4	0.34	550 – 10450	4.0							
WKK3372		M	14 46 38.7	-66 26 58	314.09	-6.11	S 5	67 $\times$ 32	15.2	0.30	550 – 10450	3.5	7050 – 7700						
WKK3823		M	13 57 33.1	-52 06 43	313.13	9.45	S M:	20 $\times$ 6	18.6	0.44	300 – 10550	7.3	650 – 1000	*	8.7	27483 $\pm$ 85	RS06	opt	
WKK3836		M	14 00 06.4	-52 03 02	313.53	9.40	S L	83 $\times$ 15	16.4	0.42	300 – 10550	7.3	650 – 1000	*	8.5	3612 $\pm$ 12	HIPASS	HI	
WKK3991		MI	14 27 30.8	-52 07 15	317.55	8.00	S M	34 $\times$ 8	18.0	0.40	600 – 5700	6.1		0.8	17164 $\pm$ 52	FH95	opt		
																16968 $\pm$ 85	RS06	opt	
WKK4751		M	15 14 36.0	-48 12 41	326.11	8.11	SY 5	56 $\times$ 19	16.5	0.40	400 – 10250	5.1	650 – 1100	*	2.9				
WKK4755		M	15 14 50.4	-48 12 44	326.15	8.09	S M:	58 $\times$ 35	15.8	0.40	400 – 10250	5.1	650 – 1100	*	2.9				
Y68-3L	ESO068-G003	I	15 20 15	-69 02 52:	315.61	-9.92	S	72 $\times$ 24	15.6N	0.11	300 – 5500	5.4							
WKK4907		MI	15 25 06.2	-48 49 03	327.26	6.66	S 5	40 $\times$ 16	16.9	0.39	600 – 9700	7.9				4981 $\pm$ 37	FH95	opt	
WKK4989		M	15 29 48.8	-53 59 34	324.95	1.97	S	43 $\times$ 11	17.1	2.69	300 – 10250	4.0	1100 – 1350		0.8	10525 $\pm$ 70	VY96	opt	
WKK5039		M	15 32 36.7	-62 52 33	320.16	-5.53	S L?	42 $\times$ 20	16.3	0.48	400 – 10250	3.6	1100 – 1300						
WKK5061		M	15 33 29.7	-60 21 38	321.71	-3.54	S	23 $\times$ 13	17.0	0.83	600 – 10350	4.0							
WKK5124		M	15 37 12.1	-60 25 09	322.05	-3.85	?I	24 $\times$ 20	16.8	0.71	400 – 10250	5.6							
WKK5131		M	15 37 41.6	-62 33 06	320.83	-5.61		20 $\times$ 12	17.4	0.50	300 – 10250	5.0							
WKK5138		M	15 38 05.3	-59 47 13	322.51	-3.41	S	46 $\times$ 35	15.5	1.02	200 – 10250	3.6	650 – 1000	0.7		5151 $\pm$ 70	VY96	opt	
WKK5186		MI	15 40 44.8	-60 05 22	322.60	-3.85	S 6	46 $\times$ 26	15.5	0.74	600 – 10250	5.7							
WKK5195		MI	15 41 11.6	-59 58 50	322.71	-3.80	S	28 $\times$ 17	16.7	0.73	300 – 10250	5.9							
WKK5196		M	15 41 14.9	-60 38 34	322.31	-4.33	S	24 $\times$ 7	17.6	0.59	300 – 10250	5.7							
WKK5251		M	15 45 16.8	-59 21 45	323.49	-3.62	S	20 $\times$ 8	17.9	0.80	300 – 10250	6.1							
WKK5267+		M	15 46 47.8	-66 24 04	319.25	-9.26	S	62 $\times$ 8	16.9	0.13	600 – 10450	3.4	4550 – 5050	*					
WKK5268		M	15 46 19.5	-58 53 20	323.89	-3.33	S	24 $\times$ 11	16.9	0.61	300 – 10350	6.3					5541 $\pm$ 46	WK04	opt

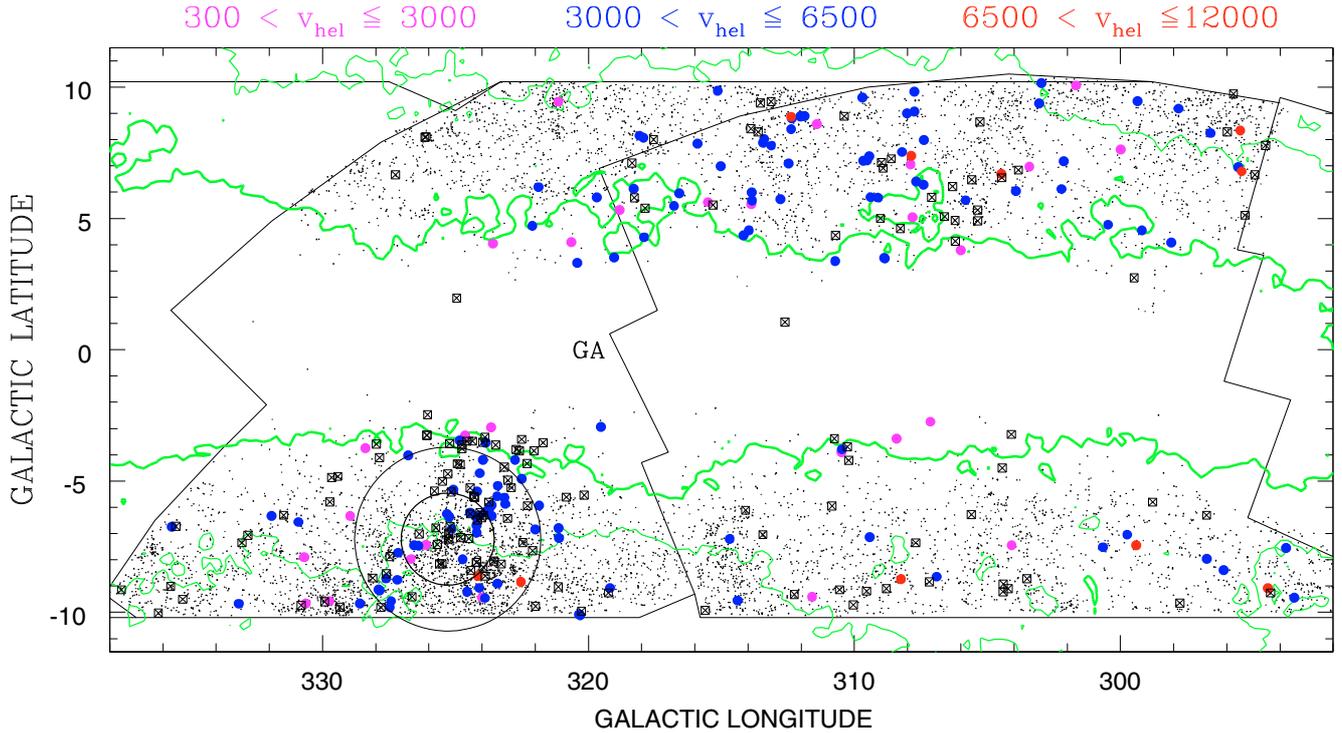
Table 4. continued.

Ident.	Other	IR	RA (h m s)	Dec (deg ' ")	gal $\ell$ (deg)	gal $b$ (deg)	Type	$D \times d$ (")	$B_J$ ( $m$ )	$E_{(B-V)}$ ( $m$ )	$V_{\text{range}}^{\text{obs}}$ $\text{km s}^{-1}$	rms mJy	$V_{\text{range}}^{\text{pert}}$ $\text{km s}^{-1}$	$N$	dist (')	$V_{\text{other}}$ $\text{km s}^{-1}$	Ref	origin
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
WKK5288		M	15 47 21.5	-60 14 18	323.16	-4.47	S	L 52x 19	15.9	0.58	600 - 10350	5.4						
WKK5297+			15 47 41.7	-58 59 27	323.97	-3.52	S	7 51x 19	15.8	0.60	600 - 10450	5.3	5300 - 5650 5950 - 6150	*		4343 $\pm$ 52	WK04	opt
WKK5330			15 49 06.3	-60 42 39	323.03	-4.97	S	9 63x 34	15.1	0.61	600 - 10550	3.8						
WKK5334		M	15 49 19.8	-61 55 59	322.29	-5.94	S	? 44x 20	15.8	0.35	300 - 10350	4.2	8350 - 8650			6038 $\pm$ 33	WK04	opt
WKK5349		MI	15 49 42.0	-61 00 34	322.90	-5.25	S	5: 38x 9	16.9	0.48	300 - 10250	4.2						
WKK5357		M	15 49 52.4	-58 42 56	324.36	-3.48	S	M 44x 23	15.8	0.63	600 - 10350	4.3				5447 $\pm$ 44	WK04	opt
WKK5381+		D	15 51 05.4	-58 35 28	324.36	-3.48	S	32x 15	16.7	0.64	300 - 10150	3.8	2000 - 2150	*		5518 $\pm$ 98	WK04	opt
WKK5424		I	15 52 54.2	-58 34 53	324.75	-3.62	?S	19x 16	17.1	0.62	300 - 10350	4.7	4350 - 4600					
WKK5443+		M	15 53 37.7	-58 41 30	324.76	-3.77	S	5: 38x 12	16.6	0.75	150 - 10350	4.0	2850 - 3050	*		5069 $\pm$ 40	WK04	opt
WKK5482		I	15 54 51.3	-56 52 08	326.05	-2.47	?I	? 71x 60	14.9	1.14	200 - 10350	4.2	1150 - 1450					
WKK5490		M	15 55 23.9	-58 14 30	325.22	-3.57	S	27x 12	17.1	0.74	600 - 10550	4.5						
WKK5528		M	15 56 49.3	-61 48 59	323.04	-6.42	S	5: 60x 9	16.7	0.47	600 - 10250	4.2						
WKK5534+		M	15 56 58.6	-59 06 26	324.82	-4.36	S	9: 43x 26	15.8	0.56	300 - 10350	4.1	5300 - 5800	*				
WKK5544+		M	15 57 33.1	-63 21 41	322.10	-7.65	S	M 51x 13	16.1	0.26	100 - 10250	3.5	4450 - 4850 6850 - 7150	*				
WKK5556+		M	15 57 33.3	-59 01 06	324.93	-4.34	S	22x 15	16.6	0.52	1100 - 8100	4.6	5400 - 5900	*		4658 $\pm$ 162	WK99	opt
WKK5563		M	15 57 54.4	-60 53 18	323.75	-5.80	S	35x 15	16.5	0.45	600 - 10550	3.6				13060 $\pm$ 102	WK04	opt
WKK5568		M	15 58 13.2	-62 53 13	322.47	-7.34	S	3: 65x 16	15.6	0.34	300 - 10250	3.5	850 - 1000			7460 $\pm$ 70	DN97	opt
WKK5581+		MI	15 59 22.2	-66 17 55	320.26	-9.96	SB	4: 58x 39	14.8	0.11	400 - 10250	4.1	3450 - 3900	*		9750 $\pm$ 70	DN97	opt
WKK5595			15 58 40.7	-57 27 10	326.07	-3.25	I	? 30x 19	16.8	0.66	300 - 10250	5.5	800 - 1100		0.7			
WKK5596			15 59 16.0	-65 02 13	321.13	-9.03	S	L 50x 26	15.4	0.13	400 - 10250	3.2	1100 - 1300					
WKK5597			15 58 45.7	-57 27 26	326.07	-3.26	S	L? 28x 11	17.3	0.67	300 - 10250	5.5	800 - 1100					
WKK5615		MI	15 59 22.2	-60 01 24	324.45	-5.26	S	M 42x 12	16.5	0.38	600 - 7700	5.7				3936 $\pm$ 37	FH95	opt
WKK5647		M	16 00 14.4	-60 22 22	324.31	-5.59	S	L 44x 31	15.4	0.35	400 - 10250	4.6				3867 $\pm$ 70	WK99	opt
WKK5650		I	16 00 18.1	-60 25 20	324.28	-5.63	S	M 52x 19	15.6	0.34	300 - 10350	4.5	8300 - 8600					
WKK5693		M	16 01 36.8	-59 04 44	325.29	-4.73	S	? 42x 24	15.6	0.37	300 - 10250	5.9	650 - 1000					
WKK5694+		DI	16 01 48.3	-61 08 54	323.94	-6.30	S	M 66x 38	14.7	0.33	400 - 9700	4.0	8100 - 8950	*				
WKK5709+		M	16 02 12.6	-60 59 10	324.08	-6.21	SD	? 46x 26	15.5	0.32	200 - 10250	5.0	5600 - 5800	*				
WKK5733++		M	16 02 50.2	-61 10 07	324.02	-6.40	S	3 54x 9	16.4	0.31	3650 - 8950	3.8	4150 - 4500 5500 - 5850	*		6215 $\pm$ 92	WK99	opt
WKK5780+			16 04 11.7	-61 07 46	324.17	-6.48	S	6 56x 35	15.2	0.29	300 - 12950	4.4	5100 - 5700	*				
WKK5791			16 04 11.9	-59 09 28	325.49	-5.01	S	5: 95x 16	15.2	0.32	200 - 10250	4.7	800 - 1000					
WKK5801		M	16 04 24.8	-59 40 19	325.16	-5.41	S	M 44x 26	15.3	0.34	600 - 10450	4.5						
WKK5805+	ESO136-G018	M	16 04 37.5	-60 46 32	324.44	-6.25	S	5 71x 16	15.5	0.30	3450 - 8950	5.6						
WKK5923		MI	16 07 53.1	-59 13 37	325.79	-5.38	S	R3 50x 28	15.2	0.38	2400 - 7900	5.3						
WKK5928	ESO100-G011		16 08 20.8	-62 57 39	323.28	-8.16	S	5 90x 28	14.6	0.18	400 - 10250	4.2						
WKK5971		M	16 09 24.3	-62 41 18	323.56	-8.04		43x 23	15.9	0.20	300 - 10250	4.1	8350 - 8650					

Table 4. continued.

Ident.	Other	IR	RA (h m s)	Dec (deg ' ")	gal $\ell$ (deg)	gal $b$ (deg)	Type	$D \times d$ (")	$B_J$ ( $m$ )	$E_{(B-V)}$ ( $m$ )	$V_{\text{obs}}$ range km s $^{-1}$	rms mJy	$V_{\text{pert}}$ range km s $^{-1}$	$N$	dist (')	$V_{\text{other}}$ km s $^{-1}$	Ref	origin
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
WKK5983		M	16 09 52.5	-65 00 48	321.99	-9.77	S	47 $\times$ 30	15.5	0.14	400 – 10250	4.3	1100 – 1300			15050 $\pm$ 70	DN97	opt
WKK6007	ESO136-G021	M	16 10 09.5	-61 25 60	324.49	-7.19	SB 2	75 $\times$ 58	14.1	0.23	100 – 10250	4.2	5750 – 5950			14838 $\pm$ 178	WK99	opt
WKK6055			16 10 50.2	-56 25 59	327.98	-3.59	S L	43 $\times$ 17	16.7	0.58	200 – 10250	3.8	900 – 1050					
WKK6090		D	16 11 51.8	-61 11 42	324.81	-7.15	SY 5	31 $\times$ 20	16.2	0.23	600 – 10350	5.1						
WKK6092+		M	16 11 51.4	-60 37 55	325.20	-6.74	SB 2	56 $\times$ 47	14.7	0.19	600 – 10350	2.1	4900 – 5100	*		4688 $\pm$ 38	WK99	opt
WKK6154			16 12 41.8	-56 54 09	327.85	-4.11	S L	32 $\times$ 19	16.7	0.50	200 – 10350	3.7	8200 – 8750			4711 $\pm$ 58	WK04	opt
WKK6162		M	16 13 13.8	-62 34 54	323.96	-8.27	SY	44 $\times$ 17	15.9	0.17	100 – 10350	2.1	8050 – 8850					
WKK6176	ESO136-G001	MI	16 13 27.2	-60 45 51	325.25	-6.98	S 5	86 $\times$ 31	14.6	0.21	300 – 10350	6.8				4630 $\pm$ 58	WK99	opt
WKK6187		D	16 13 42.4	-62 17 14	324.20	-8.09	S	22 $\times$ 22	16.8	0.15	600 – 10550	5.2	7400 – 7600		0.9			
WKK6189			16 13 44.9	-62 17 04	324.21	-8.10	E	13 $\times$ 8	17.3	0.14	600 – 10550	5.2	7400 – 7600					
WKK6249		M	16 14 53.5	-62 53 09	323.88	-8.62	S 5	51 $\times$ 20	15.7	0.14	300 – 10350	3.1	8350 – 8650					
WKK6251		M	16 14 45.0	-60 55 36	325.25	-7.20	S 4	36 $\times$ 18	15.9	0.20	1350 – 10250	27.6	8350 – 8750	*		5689 $\pm$ 100	WK99	opt
WKK6286			16 15 14.1	-60 16 59	325.74	-6.78	S	20 $\times$ 5	18.5	0.27	2400 – 7900	4.0			7.4			
WKK6368	ESO137-G013	M	16 16 51.5	-62 21 06	324.42	-8.40	SY 5	74 $\times$ 19	15.5	0.13	600 – 10450	4.4				13242 $\pm$ 34	WK04	opt
WKK6459		M	16 18 26.7	-60 46 47	325.68	-7.41	S 5	62 $\times$ 43	14.8	0.26	200 – 10250	6.5	1100 – 1400			5268 $\pm$ 35	WK08	opt
WKK6541		M	16 20 00.9	-60 00 47	326.36	-7.01	SY M	42 $\times$ 27	15.6	0.21	300 – 10250	2.6	8350 – 8550					
WKK6640	CSRG 0801	M	16 21 46.8	-61 25 31	325.50	-8.15	S R	56 $\times$ 43	14.9	0.20	400 – 10250	3.3	1150 – 1450			4147 $\pm$ 71	WK04	opt
WKK6663		M	16 22 20.3	-61 21 28	325.60	-8.15	S 2	85 $\times$ 20	15.0	0.21	300 – 10350	5.0	1150 – 1300			3062 $\pm$ 70	WK99	opt
WKK6768		M	16 24 25.1	-56 18 41	329.42	-4.82	S 5	39 $\times$ 19	16.2	0.36	300 – 10350	11.5	700 – 1000					
WKK6830			16 25 47.8	-56 10 55	329.65	-4.87	S M:	35 $\times$ 19	16.2	0.37	300 – 10350	4.7	800 – 1050					
WKK7037		M	16 31 05.3	-59 49 06	327.47	-7.87	S 5	42 $\times$ 15	16.5	0.24	2500 – 7800	5.3	8350 – 8700			18722 $\pm$ 71	WK04	opt
WKK7042		M	16 31 00.4	-56 45 35	329.72	-5.79	S 5	78 $\times$ 42	14.6	0.35	300 – 10250	5.2	850 – 1050					
WKK7175+		M	16 35 41.2	-60 09 36	327.60	-8.53	S 5	39 $\times$ 9	16.8	0.24	1600 – 6750	6.7	3250 – 3500	*				
WKK7177	ESO137-G035	M	16 35 50.8	-61 27 60	326.63	-9.41	S 3	112 $\times$ 36	14.3	0.25	2400 – 7900	4.9				4780 $\pm$ 60	RC3	opt
WKK7248+	ESO137-G037	M	16 39 18.5	-59 53 11	328.11	-8.69	S 3	106 $\times$ 22	14.8	0.28	2400 – 7900	4.4	5450 – 5600	*		5430 $\pm$ 50	RC3	opt
WKK7320			16 42 05.3	-55 49 11	331.46	-6.30	S 5	67 $\times$ 24	15.3	0.31	200 – 10250	3.5						
WKK7375		M	16 44 37.9	-60 51 05	327.80	-9.81	S	70 $\times$ 22	15.1	0.26	300 – 10250	4.6	800 – 1000					
Y453-3	ESO453-G003	MI	16 46 35.2	-31 35 21	350.44	8.86	S 3	60 $\times$ 30	13.61	0.43	600 – 5800	4.6			0.1	6644 $\pm$ 10	MF96	opt
WKK7625		M	16 52 14.6	-59 40 10	329.34	-9.80	SB 5	65 $\times$ 54	14.8	0.21	100 – 10250	2.8	1200 – 1350			14278 $\pm$ 40	WK04	opt
WKK7635			16 52 14.4	-55 16 39	332.80	-7.06	? I	78 $\times$ 54	14.7	0.26	300 – 10250	4.7				14322 $\pm$ 85	RS06	opt
WKK7689+			16 53 48.6	-59 05 24	329.92	-9.60	I	74 $\times$ 43	15.2	0.13	300 – 10250	6.5	1300 – 1700	*		1559 $\pm$ 3	HK01	HI
WKK7726			16 54 50.5	-55 17 03	333.03	-7.35	SB	105 $\times$ 74	14.1	0.30	500 – 10250	3.8	1200 – 1350			1655 $\pm$	KD04	HI
Y453-11	ESO453-G011	MI	16 56 42.5	-31 37 16	351.78	7.16	S 3	78 $\times$ 18	15.8N	0.33	500 – 9700	6.3			0.1	7028 $\pm$ 1	HW00	opt
WKK7794+		MI	16 58 40.8	-58 29 06	330.80	-9.73	SB 4	51 $\times$ 44	15.1	0.19	500 – 5800	5.4		*	0.8	5854 $\pm$ 70	VY96	opt
WKK7853			17 01 44.2	-52 57 14	335.51	-6.72	S 5	52 $\times$ 15	16.2	0.39	300 – 10350	8.8	700 – 1050					
Y17030-48		MI	17 06 43.5	-48 23 59	339.64	-4.61	S	48 $\times$		0.86	400 – 9800	5.5	8750 – 8900		0.5			





**Fig. 3.** Distribution of galaxies in the Crux and GA ZOA regions. Filled circles indicate the 162 21 cm detections, crosses in squares the 152 non-detections. The small dots represent the galaxies uncovered within the optical search regions (outlined areas). The contours show the dust extinction as determined from the  $100\ \mu\text{m}$  DIRBE maps (Schlegel et al. 1998) at the levels  $A_B = 1^m0$  and  $3^m0$  (thick line). The circles are centred on the Norma cluster with  $1 R_A$  and  $2 R_A$ .

i.e., extending from the Norma cluster at  $(\ell, b, v) = (325.29^\circ, -7.21^\circ, 4821\ \text{km s}^{-1})$  (Woudt et al. 2008) towards the low-latitude CIZA J1324.7–5736 and Cen-Crux clusters at  $(\ell, b, v) = (307.4^\circ, +5.0^\circ, 5700\ \text{km s}^{-1})$  and  $(305^\circ, +5^\circ, 6214\ \text{km s}^{-1})$ , respectively (Radburn-Smith et al. 2006, see also their Fig. 4), which form part of the GA Wall; (ii) for some highly obscured galaxy candidates deep into the ZOA (in total 37 were observed with  $A_B > 3^m0$  of which 20 were detected) as HI observations are the only way to obtain a redshift for such heavily obscured galaxies.

Overall the detections and non-detections seem to be similarly distributed over the survey area. However, a closer look at the Norma cluster (see also Fig. 5) reveals that the detection rate within one Abell radius ( $R_A = 1^m75$ ) of the central cD galaxy, WKK 6292, is only 41% ( $n_{\text{tot}} = 32$ ), which is lower than for the whole survey on the  $1\sigma$  level. A bit further out, in the annulus  $1 - 2 R_A$ , the detection rate is similar to the rest of the GA/Crux survey, namely 53% ( $n_{\text{tot}} = 53$ ). Such a trend, if real, would be expected if there are not many spiral galaxies in the cluster or if the spirals are HI deficient. The former is unlikely as morphological distinction between ellipticals and spirals is largely unaffected at the extinction levels of the Norma cluster. The latter is probable since rich, massive, and X-ray strong galaxy clusters like the Norma cluster generally show HI deficiencies (Giovannelli & Haynes 1985). We explore this effect in more detail in Sect. 6.

## 6. HI deficiency in the Norma cluster

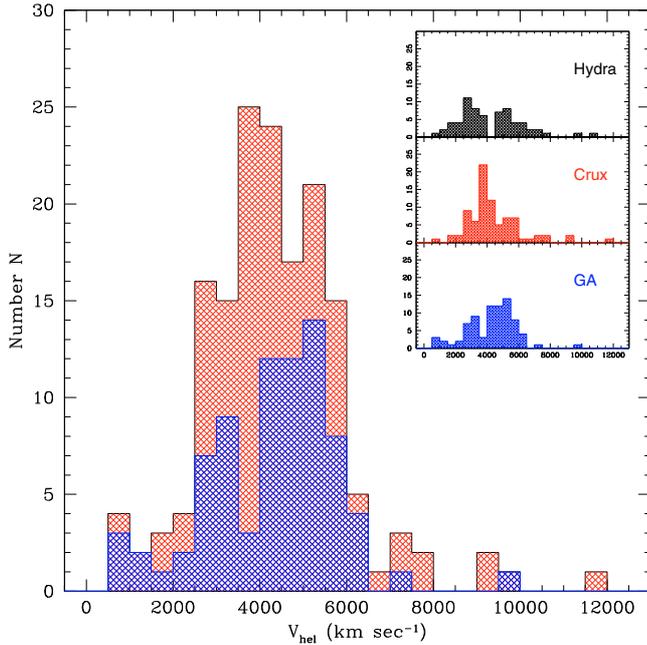
As a first measure of HI-deficiency we regard the HI-masses of the galaxies in and around the cluster as a function of

**Table 5.** References for independent velocity determinations.

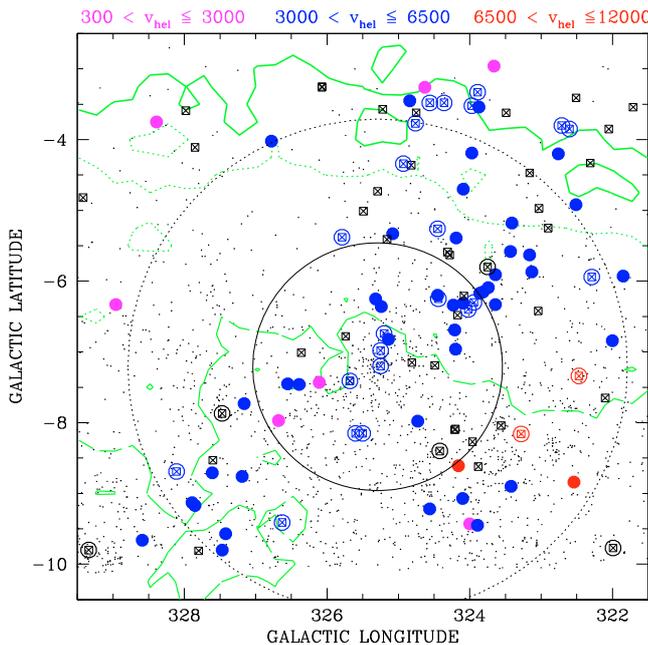
Velocity range	Counts
800–1000	19
1200–1350	15
3200	1
3700–3800	2
4450	2
4900	1
5800	1
6000	1
7000	3
7200–7300	3
7500–7700	6
8100	1
8300–8500	21
8800–9000	2
9300	1
10000	1
10 100–10 300	4

cluster-centric distance. The HI masses are calculated using  $M_{\text{HI}} = 2.356 \times 10^5 D^2 S$ , where  $S$  is the HI flux integral in  $\text{Jy km s}^{-1}$ , and  $D$  the distance in Mpc calculated from the measured velocity and corrected for the motion with respect to the Local Group (Yahil et al. 1977). For galaxies assumed to lie in the Norma cluster (i.e., within  $1.5 R_A$  and  $2096\ \text{km s}^{-1} < v < 7646\ \text{km s}^{-1}$ , cf. Woudt et al. 2008) we adopt a distance of  $D = 67 h_{70}^{-1}$  Mpc.

Figure 6 shows histograms of the logarithm of HI mass for galaxies in the inner region of the Norma cluster ( $< 0.5 R_A$ , top panel), three different annuli ( $0.5 - 1 R_A$ ;  $1 - 1.5 R_A$ ,

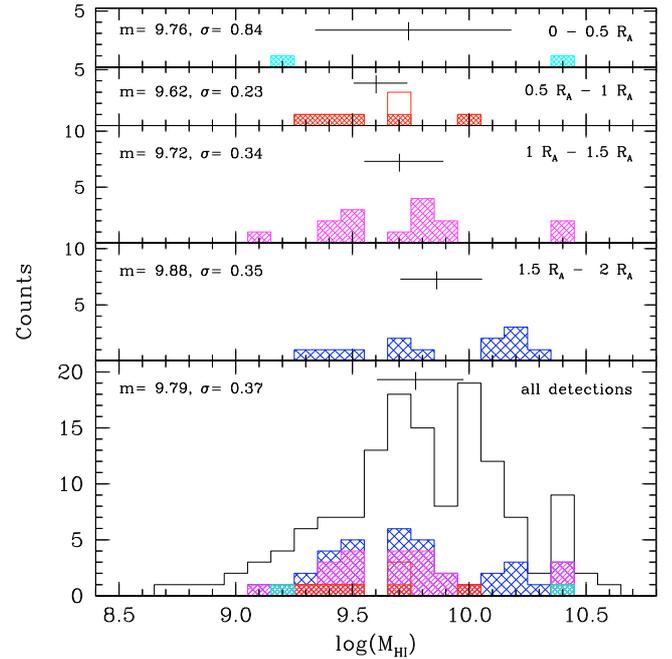


**Fig. 4.** Velocity distribution of the 162 HI detections in the Crux (light grey/red) and GA (dark grey/blue) regions. The inset shows the detections separated by regions; the detections in the Hydra/Antlia region from Paper I are also shown.



**Fig. 5.** Distribution of the galaxies observed at 21 cm zoomed in at the Norma cluster (cf. description of Fig. 3). A third contour level at  $A_B = 2''0$  is shown as a dotted line. Non-detections with a large circle have a known optical velocity (a black circle stands for  $v > 12000 \text{ km s}^{-1}$ ).

and  $1.5-2 R_A$ , middle panels), including for comparison the HI-mass distribution of all the 162 detections in the survey area (bottom panel). For reference, the hashed histograms are shown in accumulation in the bottom panel as well. The mean values and the standard deviations are indicated for each subset and for the total region in the bottom panel. Our median value of all detections is  $\log M_{\text{HI}} = 9.86$  (in units of solar mass) and compares well with the HI mass distribution in the Northern Extension of



**Fig. 6.** Histogram of the logarithm of HI mass for various regions in the Norma cluster (hashed) and the total region observed (non-hashed). The non-hashed region in the second panel from the top indicates two galaxies (WKK 6689 and WKK 6732) with an uncertain though small contribution from each other. The HI mass in both cases is therefore slightly overestimated.

the HIZOA survey ( $\log M_{\text{HI}} = 9.7$ , Donley et al. 2005) which has a similar sensitivity to our pointed survey. These histograms show that galaxies closer to the cluster core have lower HI mass than farther galaxies, although at only about the  $1\sigma$  level.

In the innermost region only two galaxies (out of nine; 22%) were detected, one of which actually has a substantial HI-mass (WKK 5999 lies at  $d = 0.49 R_A$  and  $v = 3244 \text{ km s}^{-1}$ ). Apart from this galaxy, the distribution of HI mass for the galaxies within  $1.5 R_A$  is shifted towards the lower end as compared to the field. This is expected if we assume that cluster members have passed at least once through the centre of the cluster and have undergone ram-pressure stripping. In contrast, galaxies in the range  $1.5-2 R_A$  have an HI mass distribution comparable to the field.

A better estimate of the effect of the cluster environment on the HI content of the Norma spiral galaxies is the HI deficiency parameter (Giovanelli & Haynes 1985) which compares the HI content of a cluster galaxy with the average HI content of an isolated field spiral of the same morphological type. Solanes et al. (1996) have shown that the HI content of a field spiral also depends on the diameter. However, due to the uncertainties in diameter of our highly obscured galaxies we have not included the diameter dependence in our calculations. Moreover, there is uncertainty in the morphology of many of the highly obscured galaxies. Such obscured galaxies were generally labelled as “S” by Woudt & Kraan-Korteweg (2001) without a further subtype. We assumed these to be late type spirals (i.e., Scd or Sd), as a bulge dominated spiral could have been classified, whereas strongly obscured low-surface brightness irregular galaxies would most likely have remained invisible on the optical survey plate.

We note furthermore, that our sample of latest type spirals (Sdm – I) shows a systematic offset in HI mass compared

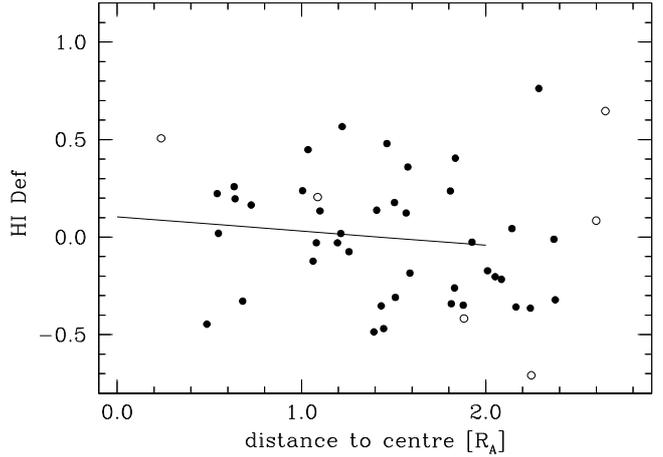
to our other morphological sub-samples. The mean HI mass of this latest type sample (not including the possibly HI-deficient Norma galaxies within  $2 R_A$ ) is  $\log M_{\text{HI}} = 9.79$  with a standard deviation of 0.33. This value is typical of Scd and Sd galaxies ( $\log M_{\text{HI}} = 9.62$ , with a standard deviation of 0.31) and consistent with the fact that Giovanelli & Haynes (1985) find the value 9.09 for their field Sm – Im sample (all HI masses from Giovanelli & Haynes were corrected for the difference of their adopted Hubble constant of  $50 \text{ km s}^{-1} \text{ Mpc}^{-1}$  to our value of  $70 \text{ km s}^{-1} \text{ Mpc}^{-1}$ ). Considering the high foreground extinction of our sample, we assume that most of the galaxies classified as late type S/Im were probably misclassified: it is unlikely to find more than a couple of very late-type galaxies at these foreground extinctions. Hence, we have calculated the HI deficiency parameter for the Sdm – I galaxy sample using the average HI content of field galaxies of types Scd and Sd.

The derived HI deficiency parameters are plotted as a function of cluster-centric distance out to  $2 R_A$ , as illustrated in Fig. 7. The dispersion is quite large and only a very weak dependence is seen. The least squares fit out to a radius of  $2 R_A$  has a slope of  $-0.07 \pm 0.12$ . A comparison with the respective plot for the Coma cluster (Bravo-Alfaro et al. 2000, their Fig. 4) which is similar to the Norma cluster in its cluster specific properties (Kraan-Korteweg et al. 1996; Woudt 1998), shows that we have only one detection within  $0.4 R_A$ , whereas Coma shows obvious deficiencies for seven central galaxies. This one detection (WKK 6100) is of unknown morphological type. Revisiting the *R*- and *J*-band images and taking account of the effect of extinction, it is likely that this galaxy is actually an Sc galaxy, that would make this galaxy more deficient.

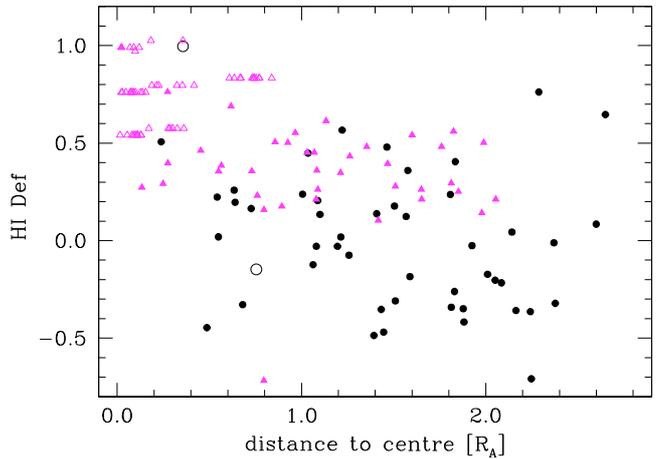
However, the fact that we have six non-detections within  $d = 0.49 R_A$  of the Norma cluster indirectly suggests that the cluster is even more HI deficient than suggested by Fig. 7. These galaxies must lie below our sensitivity limit. To test this, we looked at the non-detections that have optically determined velocities. Based on that, we can test whether they are part of the cluster or cluster environment. These are identified with open circles in Fig. 5. Nearly all non-detections with optically known velocities have velocities consistent with being part of the cluster (blue open circles with crosses). For these we have calculated upper limits of the HI-mass based on our measured rms, assuming that we would have detected the galaxy if it had an  $S/N = 3$ , and a 50% line width typical of a spiral galaxy of  $200 \text{ km s}^{-1}$ . These values are added to the sample’s HI deficiency parameters, and shown in Fig. 8.

This is not all the data available to test the HI deficiency hypothesis. Vollmer et al. (2001) obtained ATCA radio synthesis imaging observations of the centre of the Norma cluster as well as for two fields just slightly offset from the centre. In all three fields (with a *HPBW* of  $30'$ ) they detected only two galaxies (both were not observed by us). That alone presents an indication of HI deficiency. Only one of their two detected galaxies is clearly HI deficient: WKK 6489 lies at  $0.36 R_A$  and has an HI deficiency of 1.0, while the other galaxy detected by them, WKK 6801, at  $0.75 R_A$  has a normal value of  $-0.15$ .

The ATCA fields contain, however, many more spiral galaxy candidates (the reason why these fields were chosen for observations). We assume that all the spiral galaxies in the ATCA fields actually are members of the Norma cluster. An inspection of the velocity histograms of all known redshifts of galaxies in the Norma cluster (available from Woudt et al. 2008) in rings out to  $2 R_A$  confirms that nearly all galaxies within  $0.5 R_A$  are members of the cluster, with just a very low number of outliers (see Fig. 9). Even for the outermost ATCA field (at about  $0.65 R_A$



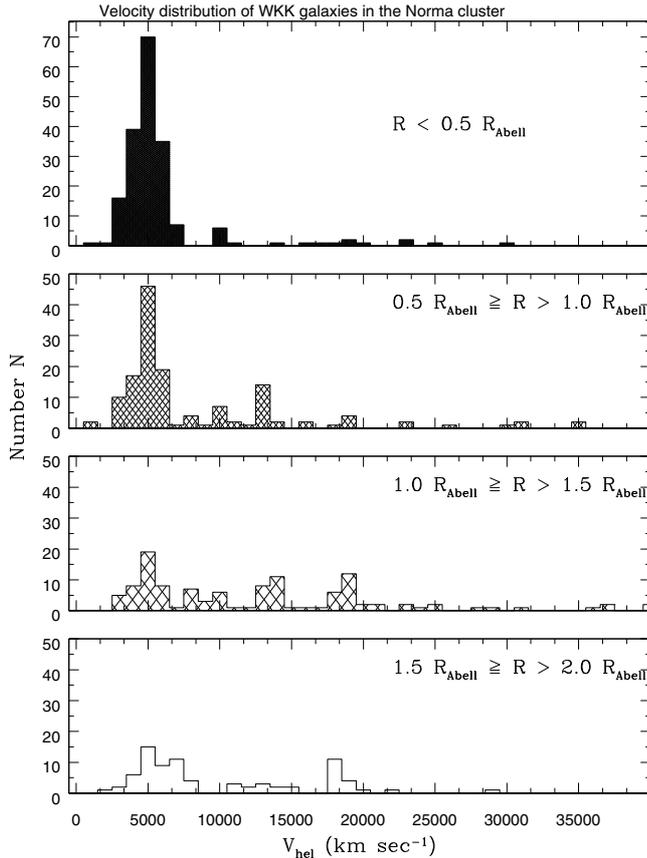
**Fig. 7.** HI deficiency parameters of Norma cluster are plotted versus distance from the centre of the cluster in Abell radii. Open circles indicate unknown spiral types or early morphological types which are not included in the fitted line. (One  $R_A$  corresponds to  $1:75$ ).



**Fig. 8.** Same as Fig. 7 but with lower limits for non-detections (triangles). Open symbols stand for ATCA data, filled symbols are from the present paper.

from the cluster centre) contamination by background or foreground galaxies will be minimal.

The ATCA non-detections have a  $3\sigma$  detection limit of about  $3 \text{ mJy/beam}$  in each velocity channel. Assuming emission to be unresolved with the  $30'$  beam in each channel, the  $3\sigma$  upper limit on HI mass for these non-detections is  $6 \times 10^8 M_\odot$  (following Vollmer et al. 2001, but with  $D = 67 \text{ Mpc}$  rather than  $D = 79 \text{ Mpc}$ , and an assumed linewidth of  $200 \text{ km s}^{-1}$  rather than  $150 \text{ km s}^{-1}$ ). Taking this limit, the calculated HI deficiency for spiral galaxies in the ATCA fields are also added to Fig. 8 (filled triangles). The addition of these lower limits now reveal a very clear and strong trend of HI deficiency for galaxies within  $0.4 R_A$ . For the annulus from  $0.4 R_A$  to  $1 R_A$  and beyond, the HI deficiency scatters between normal values to considerably deficient galaxies. This is consistent with what has been found for other rich clusters, where clear HI deficiency manifests itself unambiguously only in the innermost core of the cluster ( $R \lesssim 0.5 R_A$ ; see e.g., Haynes et al. 1984).



**Fig. 9.** Velocity distribution of WKK (optical) detections in the Norma region, separated by Abell radii, as indicated.

The non-detection rate can also be used to calculate an HI deficiency fraction as defined by Giovanelli & Haynes 1985. In our sample, we have one detection with an HI deficiency  $>0.3$  within  $1 R_A$  as well as 13 lower limits close to or above 0.3. There are an additional 8 detections and 5 non-detections which may have HI deficiencies just under 0.3. The HI deficiency fraction in this case is at least 0.58. Böhringer et al. (1996) give an X-ray luminosity for the Norma cluster of  $2.2(\pm 0.3) \times 10^{44}$  erg  $s^{-1}$  in the ROSAT energy band (0.1–2.4 keV). Figure 9 in Giovanelli & Haynes shows a relationship between the HI deficiency fraction and X-ray luminosity in the (0.5–3.0 keV) band. The values for the Norma cluster fit well onto that relationship.

For completeness, we have checked for HI deficiency in our other galaxies. There are only two outliers, WKK 1294 with  $(l, b, v) = (301^\circ.7, 10^\circ.1, 1919 \text{ km s}^{-1})$  and WKK 1510 with  $(l, b, v) = (303^\circ.4, 7^\circ.0, 2668 \text{ km s}^{-1})$ . Both are located in the vicinity of the two clusters in Crux area, the CIZA clusters (Clusters in the ZOA, Ebeling et al. 2002) CIZA 1324.7–5736 at  $(l, b, v) = (307^\circ, 5^\circ, 5700 \text{ km s}^{-1})$  and less rich Cen-Crux clusters  $(l, b, v) = (306^\circ, 5^\circ.5, 6200 \text{ km s}^{-1})$ , but not close enough to expect any HI stripping. It is therefore more likely that the morphological types (S3 and S4, respectively) are wrong, and that these galaxies are of later type. This is supported for WKK 1294, which is bright in the  $B$ -band but barely visible on the 2MASS  $J$ -band image. A later type would reduce the HI deficiency value.

## 7. Large-scale structure in the Crux and GA regions

In this section, we will discuss the new HI detections in the context of the known large-scale structures (LSS) in and across the ZOA. The new data is presented together with previously known redshifts in and adjacent to the survey area (extracted from LEDA) in a series of sky projections and redshift cones (Figs. 10 and 11). Care should be taken in the interpretation of these plots as they are based on an “uncontrolled” redshift sample of galaxies.

### 7.1. Sky projections

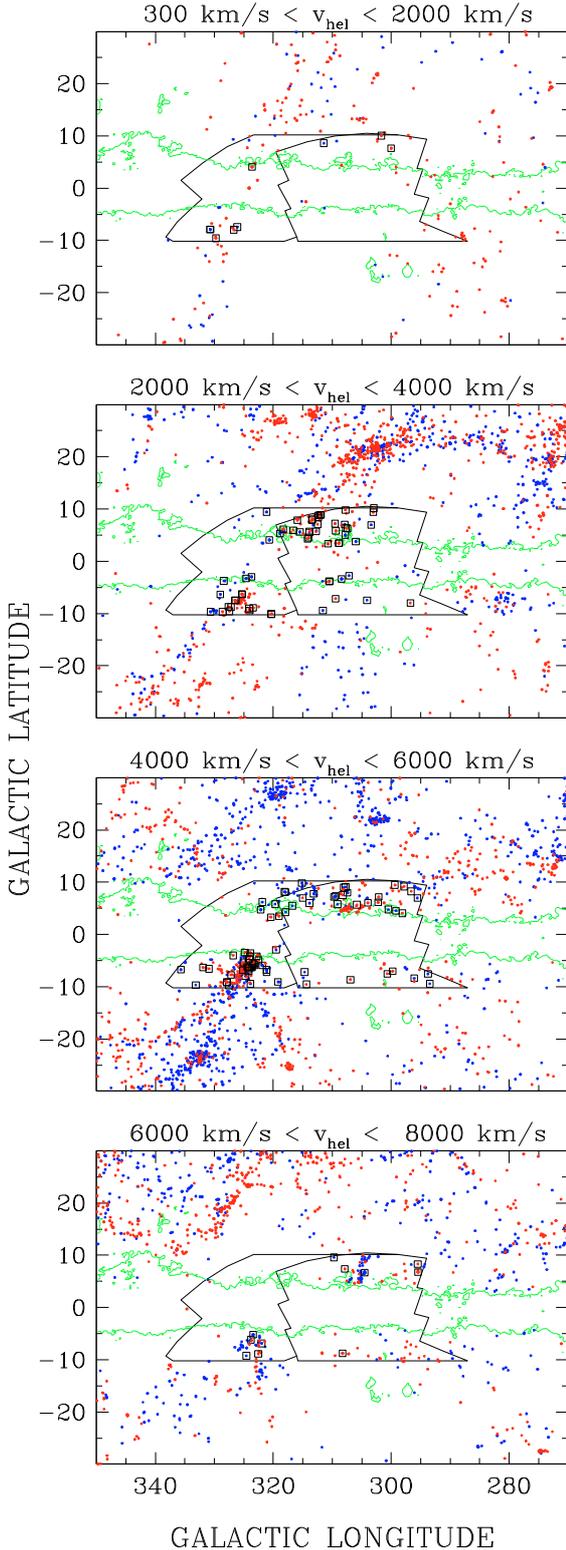
Figure 10 displays the galaxy distribution in Galactic coordinates in and around the survey region sliced in redshift intervals of width  $\Delta v = 2000 \text{ km s}^{-1}$  out to  $8000 \text{ km s}^{-1}$  (the first slice runs from  $300\text{--}2000 \text{ km s}^{-1}$ ). Higher velocity slices ( $8000\text{--}12000$ ) are not shown, as the detections for  $v > 8000 \text{ km s}^{-1}$  (see Fig. 4) are too scarce to add useful insight to the LSS at those redshifts.

What is immediately conspicuous in all four panels is that the HI detections constitute a large fraction of the galaxies with redshifts within the band limited by  $A_B < 3^m.0$  and  $b < 10^\circ$  (apart from the HI-deficient galaxies in the Norma cluster). This emphasises that HI-observations, even when dependent on optical (or NIR) pre-identification, are tremendously powerful in mapping LSS of highly obscured galaxies in and across the ZOA. Note that optical redshifts for these survey regions have been obtained earlier with the SAAO 1.9 m telescope (Fairall et al. 1998; Woudt et al. 1999), as well as with multi-object spectroscopy using the 3.6 m telescope of ESO in Chile (Woudt et al. 2004).

The first slice is quite sparsely populated. The Supergalactic Plane (SGP; de Vaucouleurs 1953) is the most prominent feature, visible here from about  $(\ell, b) = (335^\circ, -30^\circ)$  to  $(315^\circ, +30^\circ)$ , crossing the Galactic Plane (GP) at  $\ell = 325^\circ$ . Most of the detections in this panel lie along the SGP.

In the second panel (2000–4000) the Centaurus Wall (CenW) is the dominant feature (Fairall 1998; Fairall et al. 1998). It enters the panel at about  $(345^\circ, -30^\circ)$  and extends across the ZOA to the Centaurus clusters  $(302^\circ, +22^\circ)$ ; it is less inclined than the SGP. Apart from a few detections below the GP in Crux, which do not seem to highlight any particular structure, most of the HI-detected galaxies in this panel follow CenW. However, the detections above the GP spread out over a much wider area than would be expected from the quite narrow CenW, i.e., it seems to veer off toward the right ( $\sim 310^\circ, +5^\circ$ ), away from CenW. These galaxies probably are the low velocity members of the two Cen-Crux clusters discussed below which form part of the Norma Great Wall.

Despite the many HI non-detections at the core of the cluster, the Norma cluster and the Norma Great Wall – dubbed so for the first time by Woudt et al. in 1999 – are the prominent structures in the third panel. There are still a few galaxies visible that form part of CenW (blue dots above the GP around the Crux/GA border). But the majority of the detections (mostly red dots) follow the Norma Wall (Woudt et al. 1999). The Norma Wall can be traced from the Pavo II cluster ( $\sim 332^\circ, -23^\circ$ ) to the Norma cluster ( $\sim 325^\circ, -7^\circ$ ), see also Fig. 11. It crosses the Galactic Plane at  $\sim 320^\circ$ , and continues with a much shallower slope with respect to the Galactic Plane towards two neighbouring galaxy clusters at slightly higher redshift, the Cen-Crux cluster at  $(\ell, b, v) \sim (305^\circ.4, 5^\circ, 6200 \text{ km s}^{-1})$  (Woudt et al. 1999; Woudt & Kraan-Korteweg 2001) and the X-ray cluster CIZA J1324.7–736 at  $(\ell, b, v) \sim (307^\circ.4, 5^\circ, 5700 \text{ km s}^{-1})$  (Ebeling et al. 2002). From there, the Wall connects with the Vela cluster (Abell S0639;



**Fig. 10.** Sky projections in Galactic coordinates in and around the Crux/GA survey region in redshift intervals of  $\Delta v = 2000 \text{ km s}^{-1}$  for  $300 < v < 8000 \text{ km s}^{-1}$ . In each panel, the “nearer” galaxies ( $\Delta v = 1000 \text{ km s}^{-1}$ ) have blue symbols, and the more distant red symbols. The squares around the dots identify the new HI detections. The survey area and extinction contour of  $A_B = 3^m0$  are outlined.

$(\ell, b, v) = (280^{\circ}5, -10^{\circ}9, 6326 \text{ km s}^{-1})$ ; Stein 1996). The extent and shape of this wall was suspected in earlier papers (e.g., Kraan-Korteweg et al. 1994) and strongly supported in

more recent work (Woudt et al. 2004; Kraan-Korteweg 2005; Ebeling et al. 2005; Radburn-Smith et al. 2006). A sketch of this Wall, as well as the Centaurus filament, is given with Fig. 4 in Radburn-Smith et al. (2006).

In the final panel, most of the HI detections are found at the position of the Norma cluster and the two Crux clusters. They most certainly are high velocity dispersion outliers of the massive clusters (finger-of-God effect) prominent in the previous panel, rather than an indication of galaxy agglomerations at this higher velocity range.

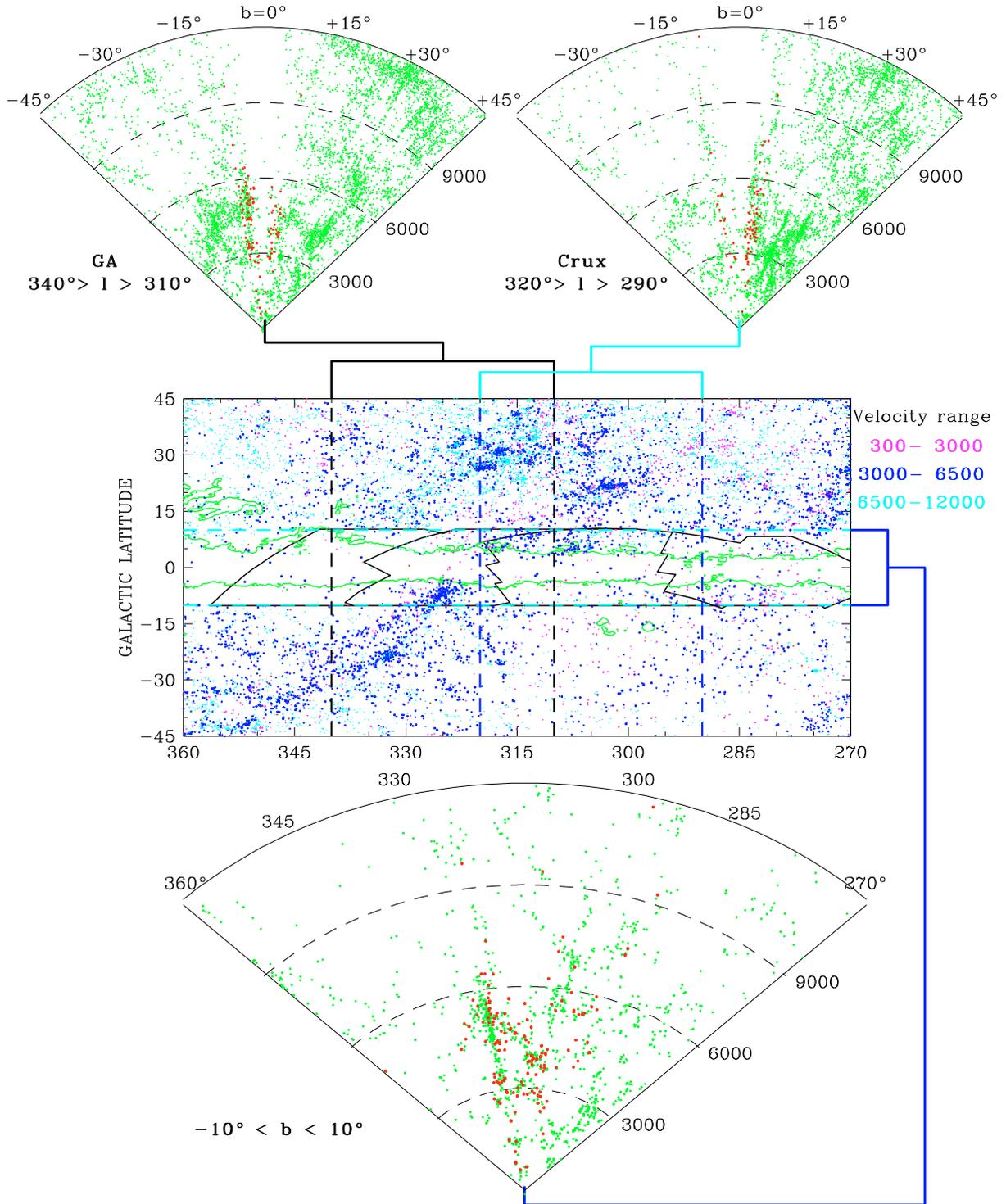
In conclusion, the new HI detections mostly help to delineate filaments and walls deeper into the ZOA. They provide supporting evidence that the Norma Wall crosses the ZOA, but then turns away from CenW towards Vela. A much smaller number of galaxies seem to form part of the general field. The slices also indicate that the HI observations of galaxies allow the mapping of LSS to quite high dust column-densities, higher than can be achieved with optical spectroscopy.

## 7.2. Pie diagrams

The above findings are confirmed with Fig. 11, which shows the new detections in a composite of pie diagrams that cover a wider area than the previous figure to reveal the overall LSS in this part of the sky. The two top panels show redshift slices out to  $12000 \text{ km s}^{-1}$ , the maximum redshift range of our HI observations. They are  $30^{\circ}$  wide in longitude, with the left one centred on the GA survey region ( $340^{\circ} > \ell > 310^{\circ}$ ) and the right one centred on the Crux survey region ( $310^{\circ} > \ell > 280^{\circ}$ ). Note that there is a longitude overlap of  $10^{\circ}$  to facilitate the visualisation of the structures running from one wedge diagram to the next. The pie diagram for these two longitude strips run from  $-45^{\circ}$  across the ZOA to  $+45^{\circ}$ . The bottom panel displays a pie diagram of the ZOA ( $|b| \leq 10^{\circ}$ ) for the longitude range  $360^{\circ} - 270^{\circ}$  as in the sky projection plot in the middle panel. The middle panel displays the projected LSS distribution of galaxies out to  $12000 \text{ km s}^{-1}$ , with blue dots marking the distance range of Norma and the Norma Wall ( $3000 - 6500 \text{ km s}^{-1}$ ), magenta the nearer galaxies ( $300 - 3000 \text{ km s}^{-1}$ ), and cyan the distant galaxies ( $6500 - 12000 \text{ km s}^{-1}$ ). This panel is meant for orientation and interpretation of the pie diagrams. The plot is collapsed in latitude.

The pie diagrams confirm that HI-observations of optically selected galaxies are quite successful in reducing the ZOA down to  $|b| = 5^{\circ}$ , at least out to redshifts of about  $6000 \text{ km s}^{-1}$  (see also Fig. 4). For higher velocities the detection efficiency drops substantially and the ZOA remains increasingly empty. Such a drop in the detection rate at similar velocities can also be seen in the systematic, blind deep Parkes HI ZOA survey (HIZOA;  $|b| \leq 5^{\circ}$ ; see, e.g., Fig. 13 in Kraan-Korteweg 2005). This is not surprising given that the rms and velocity range of both surveys are similar. In that sense, the pointed Parkes HI observations presented here, which are quite successful in the range  $5^{\circ} \lesssim |b| \lesssim 10^{\circ}$ , are in fact complementary to the deep Parkes HIZOA survey of the inner optically opaque ZOA (Henning et al., in prep.; for preliminary results see Henning et al. 2005; Kraan-Korteweg et al. 2005).

The most prominent feature in the GA cone diagram (top left panel) is the Norma cluster with its finger-of-God ranging between  $2500 - 6500 \text{ km s}^{-1}$  evident at  $(b = -7^{\circ})$ . The cluster stands out even more prominently in the bottom panel which displays the ZOA slice. The HI detections (red dots) mostly hover around Norma. The cluster itself seems embedded in a wall-like structure centred at a mean velocity of  $4500 - 5000 \text{ km s}^{-1}$  which can be traced from about  $b \sim -30^{\circ}$  to the Norma cluster



**Fig. 11.** Large scale structures in and around the Crux/GA region. The top two redshift cones are centred on the GA and Crux regions, respectively, and cover the latitude range  $b \leq \pm 45^\circ$  out to  $v = 12\,000 \text{ km s}^{-1}$ . The bottom panel displays a redshift cone of the ZOA ( $|b| \leq 10^\circ$ ). Red and green dots represent the Parkes HI detections and previously determined redshifts from LEDA, respectively. The middle panel shows the sky distribution of galaxies out to the same redshift. It is meant as a guide in the interpretation of the redshift cones.

( $b = -7^\circ$ ) where we lose it in the ZOA. This is also evident in the middle panel where we see part of the wall between the Pavo II cluster (Abell S0805 at  $332^\circ, -24^\circ, 4200 \text{ km s}^{-1}$ ) and Norma. A weak continuation of the wall is visible on the other side of the GP, together with an overdensity at slightly lower velocities. The latter is probably related to CenW (see also panel 2 in Fig. 10).

We find a clearer continuation of these structures in the Crux cone (top right panel). Most of the detections lie above the GP. Hardly any detections or possible extension of the Norma cluster/wall exists below the GP. The galaxies either form part of CenW which connects with the Centaurus clusters visible in this cone at lower velocities at  $b \approx 20\text{--}30^\circ$ , or with the higher

velocity Crux clusters (Cen-Crux and CIZA J1324.7–736). The latter two also stand out in the ZOA-longitude slice displayed in the bottom panel. The link with the galaxy cluster in Vela (Abell S0639) is not visible here as the cluster with  $(\ell, b, v) = (280^\circ.5, -10^\circ.9, 6326 \text{ km s}^{-1})$  (Stein 1996) lies just beyond the Crux slice (and just beyond the latitude limit of the ZOA slice).

The bottom panel shows the galaxy distribution in the traditional “optical” ZOA, i.e., for  $|b| \lesssim 10^\circ$  for a major fraction of the southern ZOA, where near-infrared surveys are also highly incomplete (e.g., Fig. 9 in Kraan-Korteweg 2005). It is satisfying to see that real LSS including voids are now emerging within the ZOA. The HI data follow again the previously identified structures, which on average lie at slightly higher latitudes. Distinct features are the Norma cluster with its enormous velocity dispersion, as well as the Cen-Crux and CIZA cluster, clearly identifiable as clusters. As a clump (rather than a finger of God) we find an overdensity in red and green dots at about  $4000 \text{ km s}^{-1}$  that most certainly is a signature of the crossing of the Centaurus Wall across the ZOA.

The wall-like structure of Norma is not obvious in this ZOA pie diagram, as the larger structures – from Pavo to Norma and from the Crux clusters to Vela – lie just beyond the ZOA, whereas the inner ZOA ( $|b| < 5^\circ$ ) remains unprobed by this project due to the optical pre-selection of spiral galaxy candidates. However, the pie diagram will soon be filled by the deep Parkes HIZOA survey, where indeed evidence is found for the continuation of the Centaurus Wall and the Norma (or GA) Wall suggested here (see Kraan-Korteweg 2005; Henning et al. 2005, for preliminary results).

## 8. Summary

This paper presents pointed 21 cm spectral line (HI) observations obtained with the 64 m Parkes radio telescope of partially to heavily-obscured spiral galaxies uncovered in the deep optical search for galaxies in the Crux and GA regions of the ZOA (Woudt & Kraan-Korteweg 2001). Out of a total of 314 observed galaxies we have detected 162. Due to the high density of galaxies in some areas (in particular near and in the Norma cluster), a number of pointings contain more than one detection. On the other hand, some pointings of a non-detection show a chance detection of a different galaxy (with a distance to the beam centre of up to  $20'$ ).

The average rms for the detections is 4.2 mJy; 85% of all detections have an rms within the range 2–6 mJy. Non-detections have a slightly higher rms of 4.7 mJy. The mean peak flux density is 46 mJy (with a median of 39 mJy), which is significantly lower than the average detection limit of the HIPASS detections ( $\sim 70 \text{ mJy}$ ) but similar to HIZOA (Henning et al. 2005; Kraan-Korteweg et al. 2005). The HI parameters compare well with those found with HIPASS, and the velocities compare well with optical velocities found in the literature.

The detection rate in the survey area is 52%, slightly higher than in the Hydra/Antlia survey region (45%) obtained in the same way (Paper I). The exception is the core of the Norma cluster: within  $1 R_A$ , the detection rate drops to 41% as expected in case of HI deficiency. To explore this further, we have derived HI deficiency parameters for all galaxies in and around the Norma cluster. Although only a few galaxies have actually been detected within  $1 R_A$ , the lower limits of non-detections confirm that the galaxies in the Norma cluster are on average strongly HI deficient within  $0.4 R_A$ . Including three fields observed with ATCA in the Norma cluster at an earlier stage

(Vollmer et al. 2001) and calculating the upper limits for non-detected spiral galaxies strengthens this conclusion. It shows furthermore that non-detected spiral galaxies between  $0.4 R_A$  and  $1.0 R_A$  also exhibit HI deficiencies. The observed trend is similar to that seen in the Coma cluster within  $0.4 R_A$  (Bravo-Alfaro et al. 2000) and to other massive, X-ray bright galaxy clusters within  $1.0 R_A$  (Giovanelli & Haynes 1985).

The HI detections delineate large-scale structures, such as filaments, walls and voids, deeper into the ZOA than any of the other previous optical redshift follow-ups of the optically identified galaxies. Most low-velocity detections lie along the SGP, while intermediate-velocity galaxies follow the CenW. The higher-velocity galaxies ( $5000\text{--}6500 \text{ km s}^{-1}$ ) support evidence that the Norma Wall crosses the ZOA, but then turns from the CenW towards Vela. Only a small number of the detected galaxies seem to form part of the general field.

We have shown that HI observations, even when dependent on optical (or NIR) pre-identification, are quite successful in reducing the (redshift) ZOA down to  $|b| \gtrsim 5^\circ$  and in mapping LSS of highly obscured galaxies in and across the ZOA, at least out to redshifts of about  $6000 \text{ km s}^{-1}$ . For higher velocities the detection efficiency drops substantially and the ZOA remains increasingly empty. Our observations are complementary to the deep Parkes HIZOA survey of the inner optically opaque ZOA at  $|b| \leq 5^\circ$  (Kraan-Korteweg et al. 2005; Henning et al. 2005; Henning et al., in prep).

With the future Square Kilometer Array (SKA) pathfinders, the Australian ASKAP and the South African MeerKAT, the situation will be greatly improved: we will be able to close the redshift ZOA to even lower latitudes and to map the LSSs to higher redshifts and lower HI masses. For example, MeerKAT will not only be able to fully map the GA but also the Shapley cluster concentration and thus possibly solve the GA/Shapley controversy on what is the dominant contributor to the dipole motion of the universe (Kraan-Korteweg et al. 2009, and references therein).

*Acknowledgements.* We first of all would like to thank P. A. Woudt for many valuable discussions and the referee for many valuable suggestions. We have made use of the Lyon-Meudon Extragalactic Database (LEDa), supplied by the LEDa team at the Centre de Recherche Astronomique de Lyon, Observatoire de Lyon, and of the NASA/IPAC Extragalactic Database (NED), which is operated by the Jet Propulsion Laboratory, Caltech, under contract with the National Aeronautics and Space Administration. Furthermore, this research has made use of the Digitized Sky Surveys (produced at the Space Telescope Science Institute under US Government grant NAG W-2166) and of the HIPASS database provided by the ATNF under the auspices of the Multibeam Survey Working Group. RKK thanks the South African National Research Foundation for support.

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## Appendix A: Notes to individual galaxies

In the following we discuss cases where the cross-identification is not straightforward or where the signal is a combination of the signals from two or more galaxies. In many cases we quote data from Tables 1–4 (including the optical galaxy catalogue by Woudt & Kraan-Korteweg 2001), notably morphological types, sizes, and optical velocities. We have also made use of DSS<sup>4</sup> images and of images from the DENIS (Epchtein et al. 1997) and 2MASS (Skrutskie et al. 2006) surveys.

**WKK 0491/WKK 0512:** there is a second detection in the beam of WKK 0491. The small lopsided signal is probably due to WKK 0512 ( $d = 12'.4, 28'' \times 8''$ , SL) which is the largest late-type spiral in the vicinity. WKK 0493 at  $d = 10'.2 (28'' \times 6''$ , L) is an early type galaxy and less likely to be the candidate.

**WKK 0969/WKK 1117:** there is a detection in the OFF observation of WKK 1117, close to but separated from its signal. The nearest candidate is WKK 0969 at  $d = 8'.5 (16'' \times 12''$ , unknown type,  $A_B = 3^m4$ ), which is also the only galaxy found by 2MASS in this area.

**WKK 1696** has also been detected in the beam of WKK 1694 (not detected) at  $d = 8'.7$  with  $v = 6680 \text{ km s}^{-1}$ ,  $\Delta V_{50} = 300 \text{ km s}^{-1}$ ,  $\Delta V_{20} = 318 \text{ km s}^{-1}$ ,  $I = 2.47 \text{ Jy km s}^{-1}$ ,  $rms = 2.4 \text{ mJy}$ .

**WKK 2163:** the ID is ambiguous. The observed velocity is  $v = 3533 \text{ km s}^{-1}$ , and WKK 2160 at  $d = 3'.3 (27'' \times 24''$ , S) has an optical velocity of  $3512 \pm 58 \text{ km s}^{-1}$  (FW98). It is possible that we have observed WKK 2160, but if the two galaxies are genuine companions the signal probably comes from WKK 2163 ( $74'' \times 56''$ , S6) which is the larger of the two. HIPASS can barely resolve the positions, but seems to favour WKK 2163.

**WKK 2245:** it is possible that WKK 2240 (ESO173-G015,  $d = 2'.6$ , S,  $85'' \times 12''$ ) with an optical velocity of  $v = 3006 \pm 36 \text{ km s}^{-1}$  (SH92) contributes to the signal.

**WKK 2372/WKK 2402:** the distance between the galaxies is  $d = 16'.1$ , both have been detected at similar velocities, but the profiles are not confused.

<sup>4</sup> The STScI Digitized Sky Survey.

**WKK 2377/WKK 2388/WKK 2406:** this is a group of four galaxies: WKK 2377 (S7:,  $70'' \times 23''$ ), WKK 2375 (S5,  $62'' \times 56''$ ,  $4290 \pm 37 \text{ km s}^{-1}$  FH95), WKK 2388 (S5,  $36'' \times 16''$ ,  $3976 \pm 40 \text{ km s}^{-1}$ , FH95), and WKK 2406 (SL,  $55'' \times 38''$ ). WKK 2388 lies between WKK 2377 and WKK 2406 and the pointing of WKK 2388 shows a confusion of the two latter profiles at  $v \simeq 4100\text{--}4400 \text{ km s}^{-1}$ . The signal at  $v \simeq 3800\text{--}4050 \text{ km s}^{-1}$  belongs to WKK 2388 proper and the line width is assumed to be unaffected. However, due to difficulties with fitting a good baseline the flux density is somewhat uncertain. Using HIPASS we have found that WKK 2375 does not add (significantly) to the combined signal. The observations of WKK 2377 and WKK 2406 at their respective pointings are not confused at the noise level.

**WKK 2390/WKK 2392:** the close galaxy pair (at  $d = 1.2$  and  $d = 3.2$ , respectively, from the pointing position) is unresolved, and the parameters given in Table 1 refer to the full profile. The quoted velocity by VY96 refers to the IRAS detection which is also unresolved.

**WKK 2503:** also observed with HIZSS, the spectrum shows a profile reminiscent of the blended signal of two objects. WKK 2503 has a bright bulge and large faint halo with a bright star superimposed close to the bulge. No other galaxy in this area is visible either in the optical or in the NIR. At an extinction of  $A_B = 3.7$  a late-type/LSB galaxy, WKK 2503B, could be invisible even in the NIR. Table 1 gives the parameters of the full profile. The two velocities found in the literature refer to HI observations and are equally unresolved.

**WKK 2576/WKK 2595/WKK 2597:** the observed profile is a combination of the signals from three galaxies: WKK 2595 (S6,  $102'' \times 40''$ ) and WKK 2597 (S5,  $59'' \times 47''$ ,  $3973 \pm 46 \text{ km s}^{-1}$ , SH92) are a close galaxy pair ( $d = 1.2$ ); according to HIPASS, WKK 2576 at  $d = 8.4$  (S5,  $86'' \times 75''$ ,  $3948 \pm 70 \text{ km s}^{-1}$ , DN97) has a strong narrow HI profile. Table 1 gives the measurement of the full profile for the unresolved pair WKK 2595/WKK 2597, while, through comparison with HIPASS, the width and velocity of the peak at  $v \simeq 3800\text{--}3950 \text{ km s}^{-1}$  is given for WKK 2576. By removing this peak we have re-measured the width and velocity of the underlying low-intensity profile for the close galaxy pair and found  $v = 3889 \text{ km s}^{-1}$ ,  $\Delta V_{50} = 266 \text{ km s}^{-1}$ ,  $\Delta V_{20} = 313 \text{ km s}^{-1}$ .

**WKK 2640/WKK 2644:** there are two detections in the beam of WKK 2640: the narrow spike at  $v = 3705 \text{ km s}^{-1}$  is WKK 2640 (L,  $51'' \times 42''$ ), while the detection at  $v = 9404 \text{ km s}^{-1}$  is WKK 2644 (SM,  $26'' \times 9''$ ) with an optical velocity of  $9406 \pm 100 \text{ km s}^{-1}$  (WK04) at  $d = 4.3$ . Due to the very lopsided profile of WKK 2644 the high-velocity end is uncertain.

**WKK 2844/WKK 2863:** two galaxies contribute to the detected signal. HIPASS shows that WKK 2863 (S5,  $98'' \times 83''$ ,  $3778 \pm 30 \text{ km s}^{-1}$ , SE95) at  $d = 8.7$  has a strong profile with  $v \simeq 3600\text{--}3850 \text{ km s}^{-1}$ . At the position of WKK 2844 the observed profile is smaller but extends to  $v \simeq 3950 \text{ km s}^{-1}$ ; it is therefore assumed that WKK 2844 has been detected but it remains unresolved, with a velocity slightly larger than the one for WKK 2863. Table 1 gives the parameters of the full profile for WKK 2863, which is considered to be the main contributor to the signal.

**WKK 2924/WKK 2938:** there are two detections in the beam of WKK 2924: WKK 2938 (L,  $34'' \times 22''$ ) at  $d = 7.3$  has an optical velocity of  $3024 \pm 157 \text{ km s}^{-1}$  (FW98) which agrees with the narrow peak at  $v = 2864 \text{ km s}^{-1}$ . WKK 2924 (S8,  $58'' \times 22''$ ) is a more likely candidate for the signal at  $v = 3410 \text{ km s}^{-1}$ . HIPASS also shows the latter detection at the

position of WKK 2924, while nothing can be seen at the position of WKK 2938.

**WKK 2993** has a close companion (Woudt & Kraan-Korteweg 2001) which might contribute to the signal.

**WKK 3002/WKK 3006:** the two detections in the beam of WKK 3002 can not unambiguously identified: WKK 3002 (SL?,  $56'' \times 20''$ ) is more likely to be the stronger signal at  $v = 3436 \text{ km s}^{-1}$  (cf. HIPASS), while the galaxy at  $v = 2820 \text{ km s}^{-1}$  is more likely WKK 3006 ( $13'' \times 8''$ , no type).

**WKK 3023:** with  $A_B = 2.2^m$  the galaxy is unlikely to be real, and nothing is visible on DENIS or 2MASS images.

**WKK 4016/WKK 4022:** the profile is due to the blending of two signals. HIPASS shows that the high narrow peak at  $v \simeq 4680 \text{ km s}^{-1}$  is WKK 4016 (SL,  $67'' \times 48''$ ) at  $d = 12.1$ , while the broader profile is probably due to WKK 4022 proper (S5,  $91'' \times 34''$ ). Table 1 gives the parameters for the full profile for WKK 4022 and the measurements of the narrow peak alone for WKK 4016; all parameters are uncertain.

**WKK 5240:** the detection in the beam of WKK 5267 (not detected) at  $d = 11.7$  is WKK 5240 (S,  $157'' \times 13''$ ; cf. HIPASS). The profile shape is very noisy and the parameters are uncertain.

**WKK 5285:** this galaxy has been detected in the beams of three other galaxies: in the OFF observations of WKK 5534 ( $d = 6.5$ ) and of WKK 5556 ( $d = 2.7$ ), as well as in the beam of WKK 5297 (not detected) at  $d = 6.1$ . The detection with the smallest distance to the beam centre is listed in Table 1 and shown in Fig. 1, while the detection in the OFF observation of WKK 5524 is least affected by an RFI at  $v = 5900 \text{ km s}^{-1}$  next to the signal. The other measurements are:  $v = 5631 \text{ km s}^{-1}$ ,  $\Delta V_{50} = 353 \text{ km s}^{-1}$ ,  $\Delta V_{20} = 383 \text{ km s}^{-1}$ ,  $I = 15.65 \text{ Jy km s}^{-1}$ , rms = 5.3 mJy (in the beam of WKK 5297); and  $v = 5635 \text{ km s}^{-1}$ ,  $\Delta V_{50} = 357 \text{ km s}^{-1}$ ,  $\Delta V_{20} = 396 \text{ km s}^{-1}$ ,  $I = 15.17 \text{ Jy km s}^{-1}$ , rms = 3.3 mJy (in the OFF observation of WKK 5534).

**WKK 5366:** the identification is uncertain: the optical velocity is  $4822 \pm 82 \text{ km s}^{-1}$  (WK04), but both HIPASS and JS00 confirm the HI signal to be strongest at the position of WKK 5366. Since the extinction here is  $A_B = 3.8^m$ , an obscured galaxy close by cannot be excluded.

**WKK 5443OFF:** the detection found in the OFF observation of WKK 5443 was subsequently searched for the “best” position. It has also been detected by HIZSS and JS00. No galaxy could be found in the optical or NIR (DENIS, 2MASS).

**WKK 5562/WKK 5616/WKK 5642:** in the observations of both WKK 5562 and WKK 5642 a narrow single peak appears at  $v \simeq 4160 \text{ km s}^{-1}$ . Using HIPASS we determined that this signal most likely comes from WKK 5616, a late-type galaxy ( $19'' \times 5''$ ) at  $d = 5.3$  from WKK 5642 (listed in Table 1) and  $d = 12.2$  from WKK 5562 with the following parameter:  $v = 4157 \text{ km s}^{-1}$ ,  $\Delta V_{50} = 42 \text{ km s}^{-1}$ ,  $\Delta V_{20} = 75 \text{ km s}^{-1}$ ,  $I = 1.95 \text{ Jy km s}^{-1}$ , rms = 4.7 mJy.

**WKK 5595** is included in the catalogue since it is very close to the observed but undetected WKK 5597 ( $28'' \times 11''$ , L?) at  $d = 0.7$  and is of comparable size ( $30'' \times 19''$ , type unknown), that is, the rms can be considered an upper limit for both galaxies.

**WKK 5642/WKK 5659:** there are three detections in the beam of WKK 5642 ( $48'' \times 17''$ , SM): the spike at  $v = 4167 \text{ km s}^{-1}$  is WKK 5616 and has been discussed above. The signal at  $v = 6446 \text{ km s}^{-1}$  is assumed to belong to WKK 5642 since it also has two optical velocities of  $6045 \pm 42 \text{ km s}^{-1}$  (SH92) and  $v = 6118 \pm 100 \text{ km s}^{-1}$  (WK04), though this is only in moderate agreement. WKK 5670 ( $24'' \times 8''$ , SE:) at  $d = 6.6$  with an optical velocity of  $v = 6329 \pm 44 \text{ km s}^{-1}$

(WK04) can be excluded as a candidate since it is only  $d = 5'.6$  from WKK 5694, which has also been observed and shows no signal at  $v \approx 6400 \text{ km s}^{-1}$ . A third signal has been found at  $v = 4418 \text{ km s}^{-1}$  which is likely to be WKK 5659 ( $44'' \times 15''$ , S6) at  $d = 3'.4$ .

**IC 4584/IC 4585:** this is a detection in the beam of WKK 5581 (not detected). IC 4584 and IC 4585 are two large spiral galaxies at  $d \approx 9'$  from the pointing. HIPASS confirms their identity but cannot resolve the pair, though clearly both galaxies contribute to the signal. The measurement of the full profile is given in Table 1.

**WKK 5729:** the three observations of WKK 5733 ( $v_{\text{opt}} = 6215 \pm 92 \text{ km s}^{-1}$ , WK99), WKK 5694 ( $v_{\text{opt}} = 3412 \pm 36 \text{ km s}^{-1}$ , FH95), and WKK 5709 show a very similar profile both in line width and peak flux at  $v = 5729 \text{ km s}^{-1}$ ,  $v = 5730 \text{ km s}^{-1}$ , and  $v = 5723 \text{ km s}^{-1}$ , respectively. The left horn appears to come from WKK 5768 (also detected in the beam of WKK 5780), which lies at a distance of  $d = 13'.5$ ,  $d = 17'.9$ , and  $d = 11'.7$ , respectively, from the three pointings; the peak flux of this horn varies according to the distance. Due to the similar peak flux and high velocity end of the rest of the profile we conclude that the detected galaxy must lie at a similar distance from these three pointings. WKK 5729 ( $48'' \times 16''$ , SL) lies at  $d = 6'.9$ ,  $d = 9'.1$ , and  $d = 5'.9$  from WKK 5733, WKK 5694, and WKK 5709, respectively. It is a late-type spiral and therefore not visible with 2MASS and DENIS. The signal is too weak to be detectable with HIPASS.

**WKK 5768** is detected in the beam of WKK 5780 (not detected) at  $d = 9'.5$ . The low-velocity horn is also visible in the observations of WKK 5709 ( $d = 11'.7$ ; see plot of WKK 5729), WKK 5733 ( $d = 13'.5$ ) and WKK 5694 ( $d = 17'.9$ ).

**WKK 5993/WKK 5999:** the detection in the observation of WKK 5993 is the blending of two signals. The low-velocity double-horn comes from WKK 5999 (also observed, see Fig. 1), while the high-velocity part is due to WKK 5993. The parameters for WKK 5993 in Table 1 have been measured by cutting off the profile of WKK 5999 at  $v \approx 3350 \text{ km s}^{-1}$ . All the parameters are uncertain since the low-velocity end of WKK 5993 is undetermined. For the WKK 5999 profile we have measured  $v = 3261 \text{ km s}^{-1}$ ,  $\Delta V_{50} = 180 \text{ km s}^{-1}$ ,  $\Delta V_{20} = 226 \text{ km s}^{-1}$ ,  $I = 8.83 \text{ Jy km s}^{-1}$ , rms = 2.3 mJy.

**WKK 6187** is included in the catalogue since it is very close to the observed but undetected WKK 6189 ( $13'' \times 8''$ , E) at  $d = 0'.9$  and is slightly larger ( $22'' \times 22''$ , type unknown), that is, the rms can be considered an upper limit for both galaxies.

**WKK 6535/WKK 6570:** there are two detections in the beam of WKK 6570. WKK 6535 ( $39'' \times 9''$ , S5) lies at  $d = 6'.5$  and is likely to be the detection at  $v \approx 4150 \text{ km s}^{-1}$ . Since WKK 6570 ( $60'' \times 27''$ , S3) is the larger and brighter of the two we have assumed it to be the closer galaxy at  $v = 2938 \text{ km s}^{-1}$ , but the identities remain ambiguous.

**WKK 6594:** the HI galaxy is probably identical with the IRAS galaxy at  $d = 2'.2$  with  $v = 642 \pm 35 \text{ km s}^{-1}$  (SH92).

**WKK 6689/WKK 6732:** the two galaxies with similar velocities lie  $9'.6$  apart. The observation of WKK 6732 shows no significant confusion with the signal of WKK 6689 (though the flux density may be uncertain), while the profile for WKK 6689 is more uncertain.

**WKK 7287/WKK 7289:** the small signal at  $v = 5740 \text{ km s}^{-1}$  detected in the beam of WKK 7289 is probably WKK 7287 at  $d = 3'.3$  ( $30'' \times 20''$ , I).

**WKK 7460/WKK 7463** is an interacting system with a separation of  $1'.4$ : WKK 7460 ( $198'' \times 105''$ , SL) is the larger component with an optical velocity of  $775 \pm 36 \text{ km s}^{-1}$  (SH92), while

the profile gives  $v = 842 \text{ km s}^{-1}$ . Table 1 gives the full parameters for WKK 7460 only, since the contribution by WKK 7463 ( $82'' \times 67''$ , S) is uncertain. However, considering the types and sizes of the two galaxies as well as the HI velocity as compared to the optical of WKK 7460, we can assume that WKK 7463 contributes to the profile.

**WKK 7465/WKK 7198:** WKK 7198 has been detected in the OFF observation of WKK 7465 at  $d = 7'.2$ , and the profiles overlap. The observation of WKK 7198 (see Fig. 1) shows that the profile extends from  $v \approx 3270 \text{ km s}^{-1}$  to  $\sim 3540 \text{ km s}^{-1}$ . The profile of WKK 7465 is therefore truncated and no line widths and flux could be derived. The systemic velocity is likely to be higher than the one given.

**WKK 7652/WKK 7689:** WKK 7652 has been detected in the beam of WKK 7689 (not detected) at  $d = 11'.2$ . Optical velocities for this galaxy are  $v = 1350 \pm 31 \text{ km s}^{-1}$  (RC3) and  $v = 1478 \pm 38 \text{ km s}^{-1}$  (WK04), while other HI measurements find  $v = 1482 \pm 6 \text{ km s}^{-1}$  (RC3). While we find  $v = 1519 \text{ km s}^{-1}$ , HK01 has detected WKK 7689 at  $v = 1559 \pm 3 \text{ km s}^{-1}$  in HI with the radio telescope at Effelsberg, which has a smaller beam size ( $9'$  as compared to  $15'$  for Parkes). We can therefore not exclude that part of the signal in our observation comes from WKK 7689.

**WKK 7776** has also been detected in the beam of WKK 7794 at  $d = 10'.7$  with  $v = 2790 \text{ km s}^{-1}$ ,  $\Delta V_{50} = 45 \text{ km s}^{-1}$ ,  $\Delta V_{20} = 55 \text{ km s}^{-1}$ ,  $I = 4.11 \text{ Jy km s}^{-1}$ , rms = 5.6 mJy.

## Appendix B: Galaxies in the Vela region

A number of galaxies outside of the Crux and GA region were also observed within this observing programme, i.e., galaxies in the Vela region ( $245^\circ \gtrsim \ell \gtrsim 275^\circ$ ). They were taken from the ZOA deep optical galaxy catalogue (Salem & Kraan-Korteweg, in prep.; see Kraan-Korteweg & Lahav 2000, for preliminary results) that covers the region between Puppis (Saito et al. 1991) and the Hydra/Antlia region (Kraan-Korteweg 2000); see Figs. 2 and 3 in Kraan-Korteweg & Lahav 2000, for an outline of the surveyed area and the distribution of the uncovered galaxies.

The data of the detected ( $N = 14$ ) and non-detected galaxies ( $N = 15$ ) are presented in Tables B.2 and B.3, which are equivalent to Tables 1 and 4 (see Sects. 3 and 4 for the column descriptions). The profiles of the detected galaxies are shown in Fig. B.1, and Table B.1 gives the independent velocity measurements found in the literature for the detected galaxies (see the description of Table 2 in Sect. 3). The reference for KF95 is Kraan-Korteweg et al. (1995).

**Table B.1.** Comparison of velocities for Vela galaxies.

Ident.	$V_{\text{hel}}$ $\text{km s}^{-1}$	$V_{\text{other}}$ $\text{km s}^{-1}$	Origin	Reference
(1)	(2)	(3)	(4)	(5)
SKK259- 15L	2730		$2723 \pm 7$	HI HIPASS
SKK261- 17L	2979		$2974 \pm 10$	HI HIPASS
SKK262- 89L	3513		$3451 \pm 50$	opt FW98
SKK262- 36L	4650		$4651 \pm 9$	HI HIPASS
RKK1949	4030		$4002 \pm 100$	opt KF95
			$4037 \pm 36$	opt SH92
SKK263-164L	4118		$4116 \pm 1$	HI DN96
SKK263-133L	1106		$969 \pm 54$	opt FH95
			$1106 \pm 6$	HI HIPASS
SKK263- 12L	4540		$4600 \pm 40$	opt RC3
			$4545 \pm 6$	HI HIPASS

**Table B.2.** HI-detections in the Vela region.

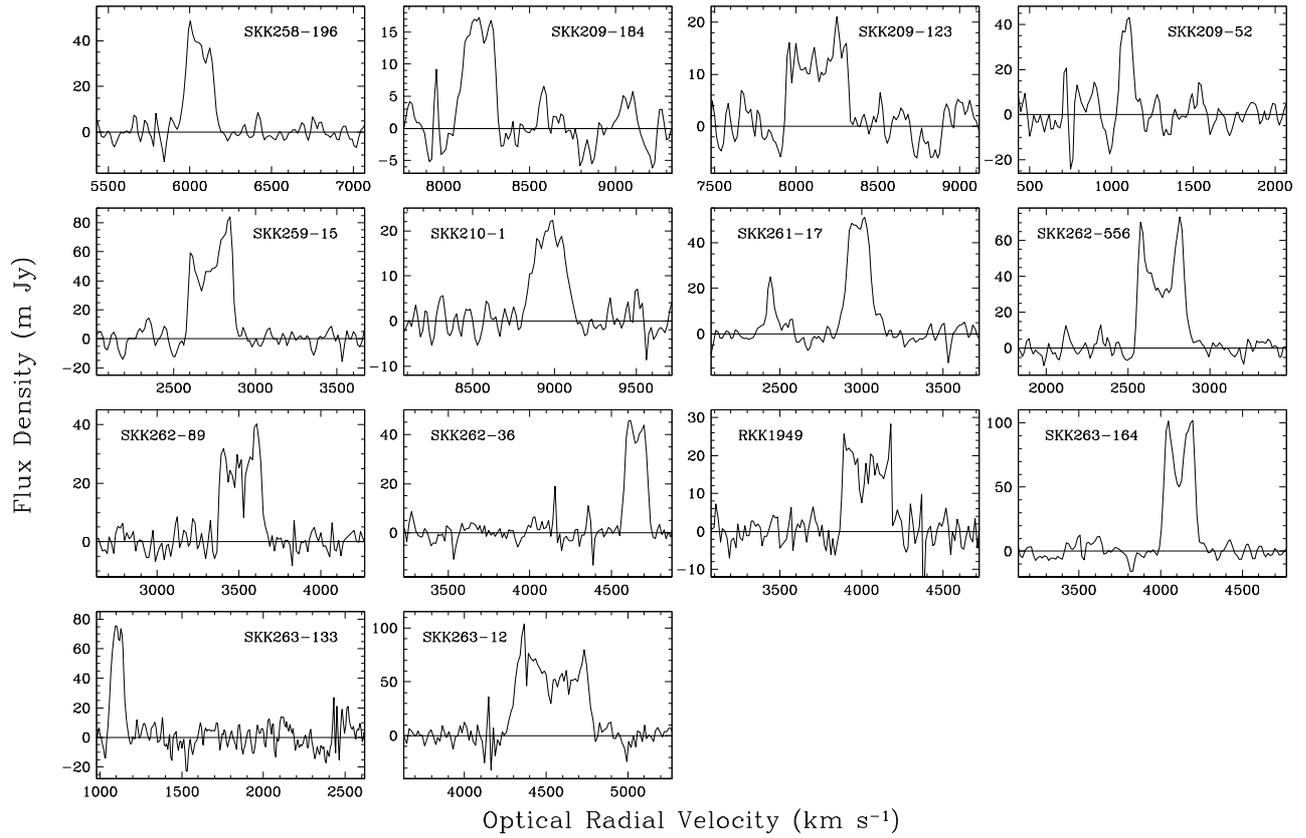
Ident.	Other	IR	RA (h m s)	Dec (deg ' ")	gal $\ell$ (deg)	gal $b$ (deg)	Type	$D \times d$ (")	$B_J$ ( $m$ )	$E_{(B-V)}$ ( $m$ )	$V_{\text{hel}}$ $\text{km s}^{-1}$	$\Delta V_{50}$ $\text{km s}^{-1}$	$I$ $\text{Jy km s}^{-1}$	rms hann mJy	$N$ dist	$I_c$ $\text{Jy km s}^{-1}$	excised RFI $\text{km s}^{-1}$			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
SKK258-196L	ESO258-G002		07 58 13.9	-47 01 09	261.52	-9.16	S	60 $\times$ 40	14.9	0.32	6174	177	220	7.25	3.5					5800
SKK209-184L	ESO209-G016	MI	08 05 29.0	-48 50 56	263.74	-9.06	SBR3	54 $\times$ 54	14.6	0.29	8196	198	240	2.98	3.0					
SKK209-123L	ESO209-G017	M	08 08 33.2	-49 03 50	264.20	-8.74	S	54 $\times$ 12	16.2	0.26	8130	378	395	4.71	3.3					
SKK209-52			08 11 34.2	-47 08 41	262.83	-7.29	I	34 $\times$ 13	16.9	0.61	1091:	79:	99:	3.49:	10.2	*				1000
SKK259-15L	ESO259-G001		08 17 31.4	-45 37 11	262.11	-5.60	S	34 $\times$ 19	16.1	0.81	2730	278	299	15.44	5.7					
SKK210-1			08 46 54.4	-47 47 53	266.85	-2.82	?	47 $\times$ 13	16.8	1.00	8969	210	285	4.20	2.8					
SKK261-17L	ESO261-G006	M	09 23 34.0	-42 45 39	267.42	5.34	S	40 $\times$ 40	15.5	0.65	2979	156	207	7.79	3.5					
SKK262-556L	ESO262-G004		09 46 22.5	-46 38 38	273.06	5.21	S	108 $\times$ 11	15.8	0.46	2709	288	319	13.73	4.2					
SKK262-89L	ESO262-G015	I	10 02 39.2	-45 29 58	274.56	7.87	S	1	60 $\times$ 24	15.1	0.19	3513	264	282	7.18:	3.5				4150
SKK262-36L	ESO262-G016	M	10 03 11.6	-42 49 08	272.99	10.06	S	3	71 $\times$ 44	14.5	0.16	4650	144	169	5.92	3.0				
RKK1949	ESO263-G004	MI	10 06 46.9	-47 41 48	276.45	6.53	SB	1	54 $\times$ 47	14.7	0.20	4030	302	316	5.26:	3.3				3350/4150
SKK263-164L	ESO263-G016	M	10 12 32.4	-45 14 13	275.82	9.11	S	3	108 $\times$ 81	13.4	0.19	4118	197	221	16.08	5.3				
SKK263-133L	ESO263-G021	I	10 14 42.0	-44 50 59	275.91	9.64			74 $\times$ 60	14.1	0.21	1106	83	106	5.92	7.8				
SKK263-12L	ESO263-G035	I	10 26 14.4	-45 44 13	278.12	10.02	S	1	121 $\times$ 47	13.6	0.18	4540	450:	491:	27.61:	7.1				4350

Notes: SKK209-52: the RFI is next to the profile and possibly affects the line width.

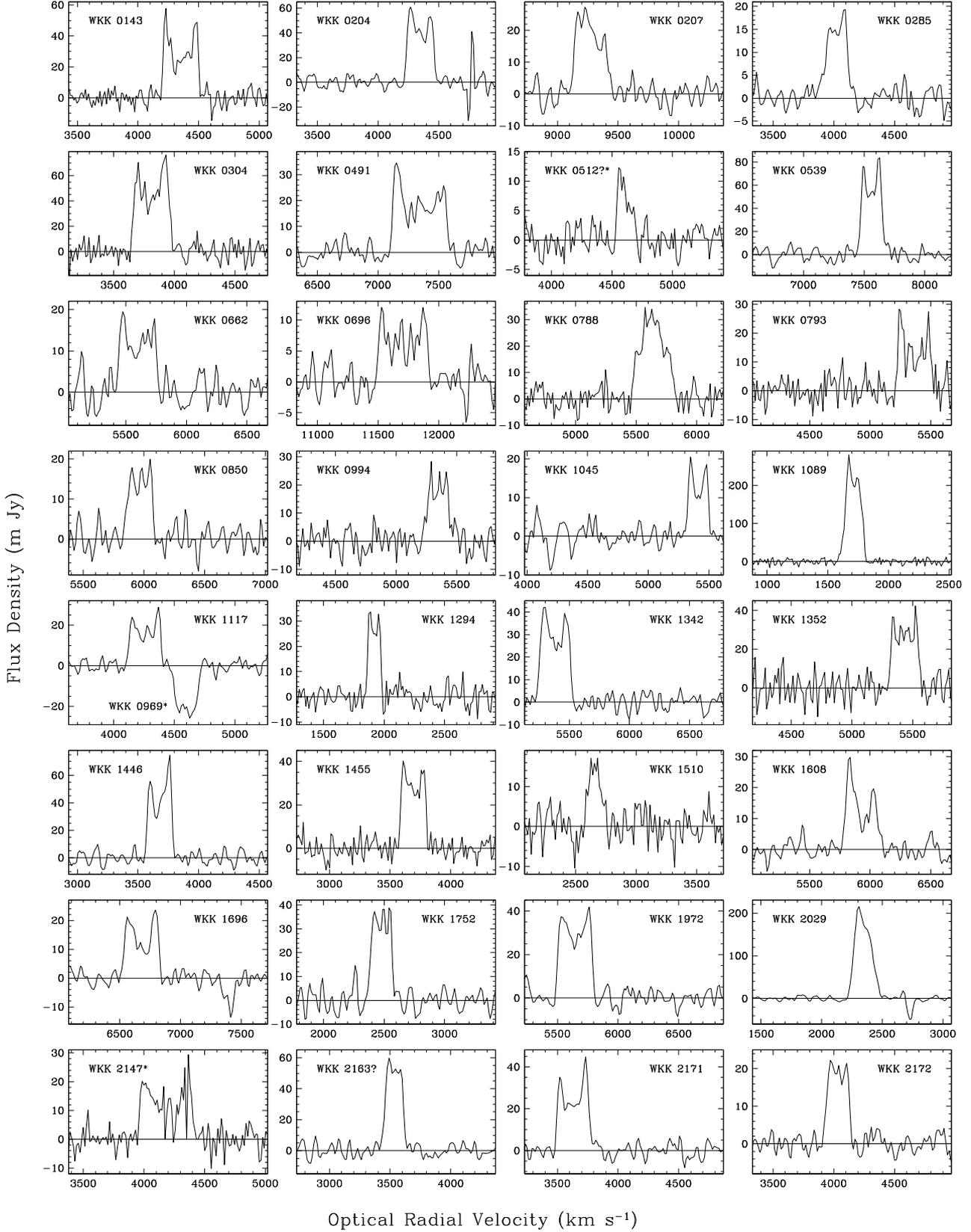
**Table B.3.** HI non-detections in the Vela region.

Ident.	Other	IR	RA (h m s)	Dec (deg ' ")	gal $\ell$ (deg)	gal $b$ (deg)	Type	$D \times d$ (")	$B_J$ ( $m$ )	$E_{(B-V)}$ ( $m$ )	$V_{\text{obs}}$ $\text{km s}^{-1}$	rms mJy	$V_{\text{pert}}$ $\text{km s}^{-1}$	$N$ dist	$V_{\text{other}}$ $\text{km s}^{-1}$	Ref	origin					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)				
SKK258-137		M	07 42 49.8	-44 12 27	257.70	-10.14	S?	47 $\times$ 27	15.9	0.31	300 - 10250	4.0										
SKK258-89		M	07 55 07.4	-45 00 26	259.49	-8.62	SM	54 $\times$ 8	17.0	0.23	300 - 10250	3.2	700 - 1100	*								
SKK209-209	LEDA 3098730	M	08 04 53.1	-49 08 50	263.95	-9.29	S	54 $\times$ 8	16.8	0.29	500 - 10250	3.5										
SKK258-14		M	08 06 10.6	-43 52 28	259.53	-6.34	SM	40 $\times$ 24	15.8	0.43	400 - 10250	4.5										
SKK312-4		M	08 09 18.5	-38 38 46	255.42	-3.04	?	20 $\times$ 20	16.6	2.45	400 - 10350	3.8	900 - 1100									
SKK259-18		M	08 14 20.1	-46 38 07	262.65	-6.62	?SL	67 $\times$ 7	16.9	0.69	500 - 10250	7.3										
SKK262-425L	ESO262-G006	M	09 48 40.3	-45 29 46	272.62	6.35	S	74 $\times$ 5	17.0	0.19	300 - 10350	4.4										
SKK262-36L	ESO262-G009		09 51 31.9	-44 01 14	272.07	7.81	S	67 $\times$ 7	16.6	0.25	400 - 10250	3.3	300 - 400									
													850 - 1050									
SKK262-303L	ESO262-G010	M	09 53 47.3	-45 58 02	273.62	6.55	S	54 $\times$ 13	16.0	0.22	300 - 10250	4.1	820 - 1020									
SKK262-127	ESO316-G015	M	10 00 53.3	-42 41 03	272.57	9.91	S	74 $\times$ 11	16.0	0.23	300 - 10250	4.6	800 - 1070	*	9796 $\pm$ 10	MF96	opt					
SKK262-59	ESO316-G019		10 02 47.0	-42 34 42	272.78	10.21	S	67 $\times$ 9	16.3	0.19	300 - 10250	4.1	800 - 1030	*								
SKK263-65L	ESO263-G008		10 07 46.1	-43 29 40	274.08	10.02	S	83 $\times$ 16	15.4	0.15	5100 - 10250	4.0										
SKK263-157L	ESO263-G014	MI	10 11 00.2	-45 09 06	275.54	9.02	S1?	67 $\times$ 50	14.4	0.19	1600 - 6700	4.5										
SKK263-53L	ESO263-G024	MI	10 15 33.7	-45 07 58	276.20	9.50	SE?	87 $\times$ 40:	14.3	0.20	-600 - 4650	6.3	-100 - 300						5200 $\pm$ 100	F83	opt	
													750 - 1100							1050 $\pm$ 100	F83	opt
SKK263-20L	ESO263-G029		10 21 09.8	-46 00 53	277.52	9.31	SE	108 $\times$ 30	14.2	0.25	300 - 5500	5.4	900 - 1030		2960 $\pm$ 60	RC3	opt					

Notes: SKK258-89: detected HVC947 at  $v = 262 \text{ km s}^{-1}$ ; SKK262-127: detected CHVC1098 at  $v = 261 \text{ km s}^{-1}$ ; SKK262-59: detected CHVC1098 at  $v = 263 \text{ km s}^{-1}$ .



**Fig. B.1.** HI profiles of the 14 HI detections in the Vela region. The vertical axis gives the flux density in mJy, the horizontal axis the velocity range (radio convention), generally centred on the radio velocity of the galaxy displaying a width of  $1600 \text{ km s}^{-1}$ . All spectra are baseline-subtracted and generally Hanning-smoothed. The respective identifications are given within the panels.



**Fig. 1.** Baseline-subtracted HI profiles of the 162 detections in the Crux/GA region. The vertical axis gives the flux density in mJy, the horizontal axis the velocity range (optical convention), generally centred on the velocity of the galaxy and displaying a width of 1600 km s<sup>-1</sup>. All spectra are baseline-subtracted and generally Hanning-smoothed. The identifications are given within the panels. Question marks indicate uncertain identifications, stars denote a detection not at the centre of the beam.

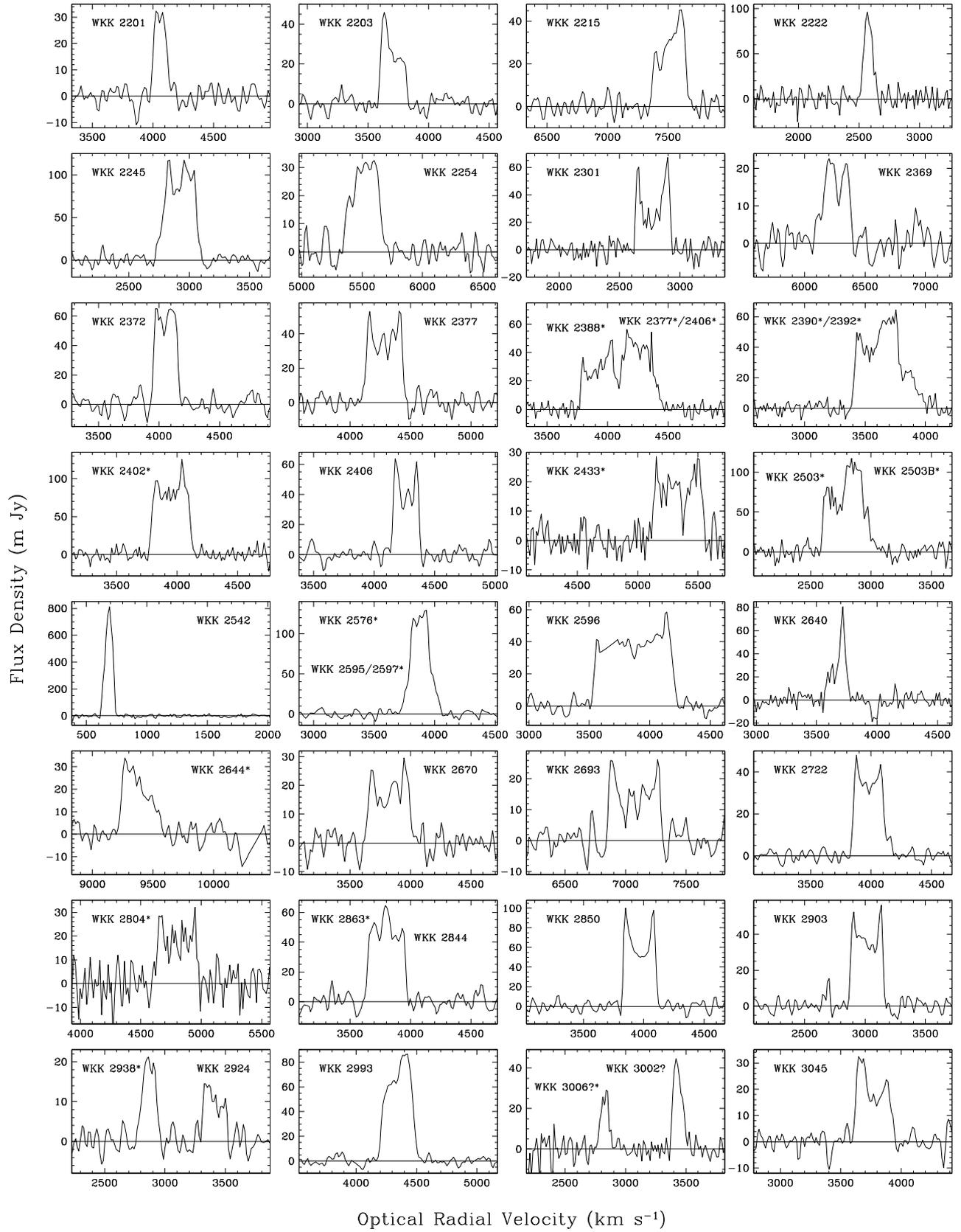


Fig. 1. continued.

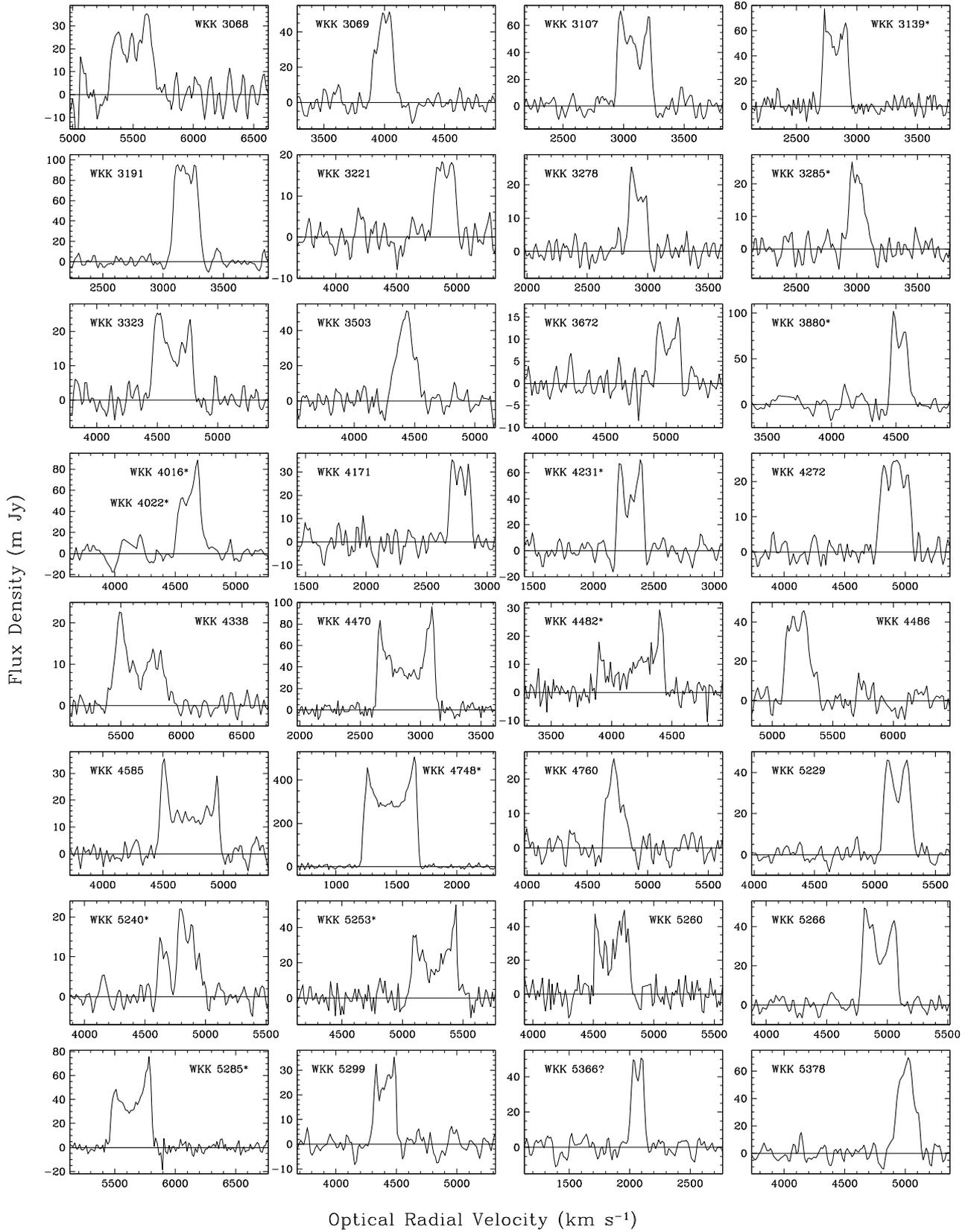


Fig. 1. continued.

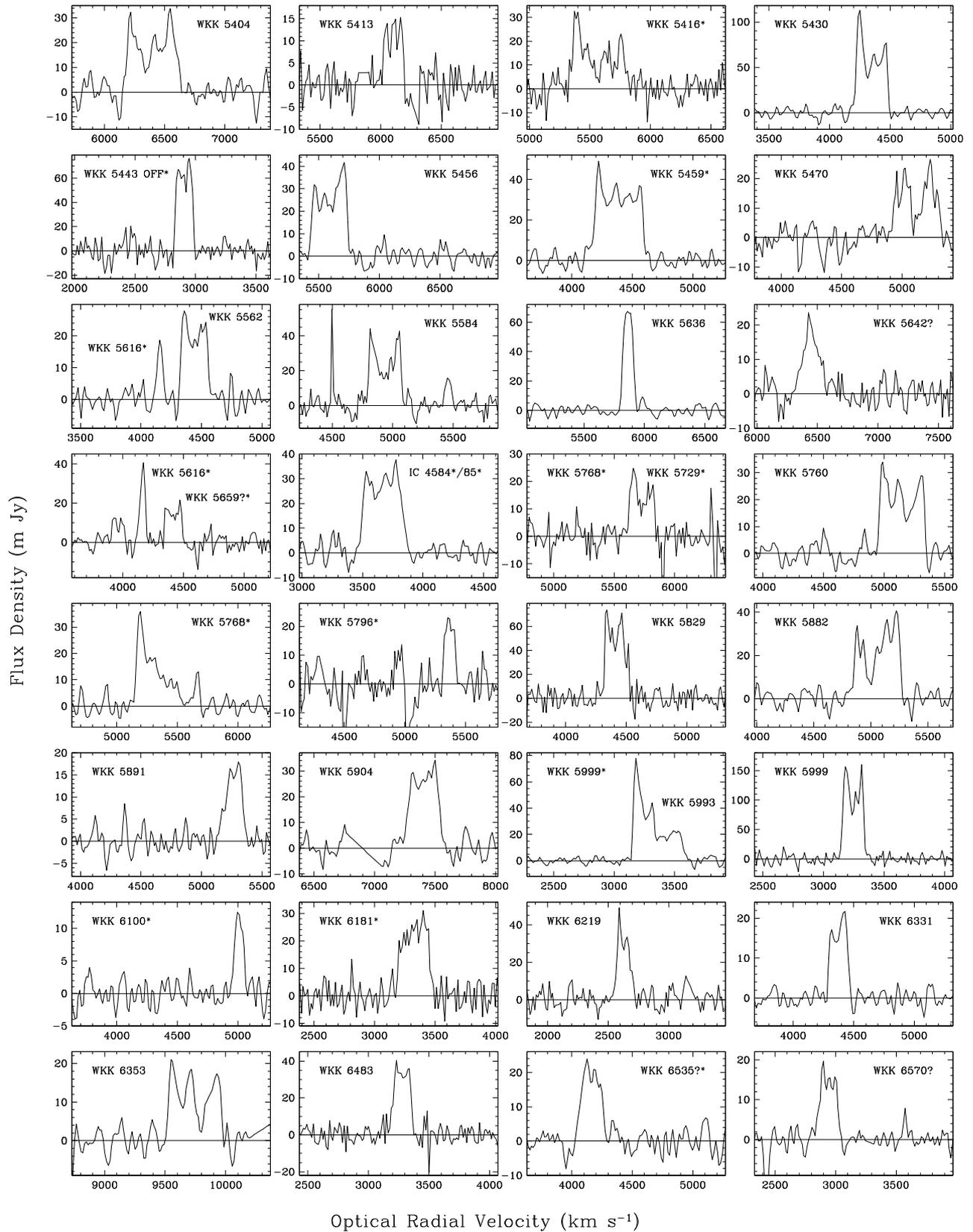


Fig. 1. continued.

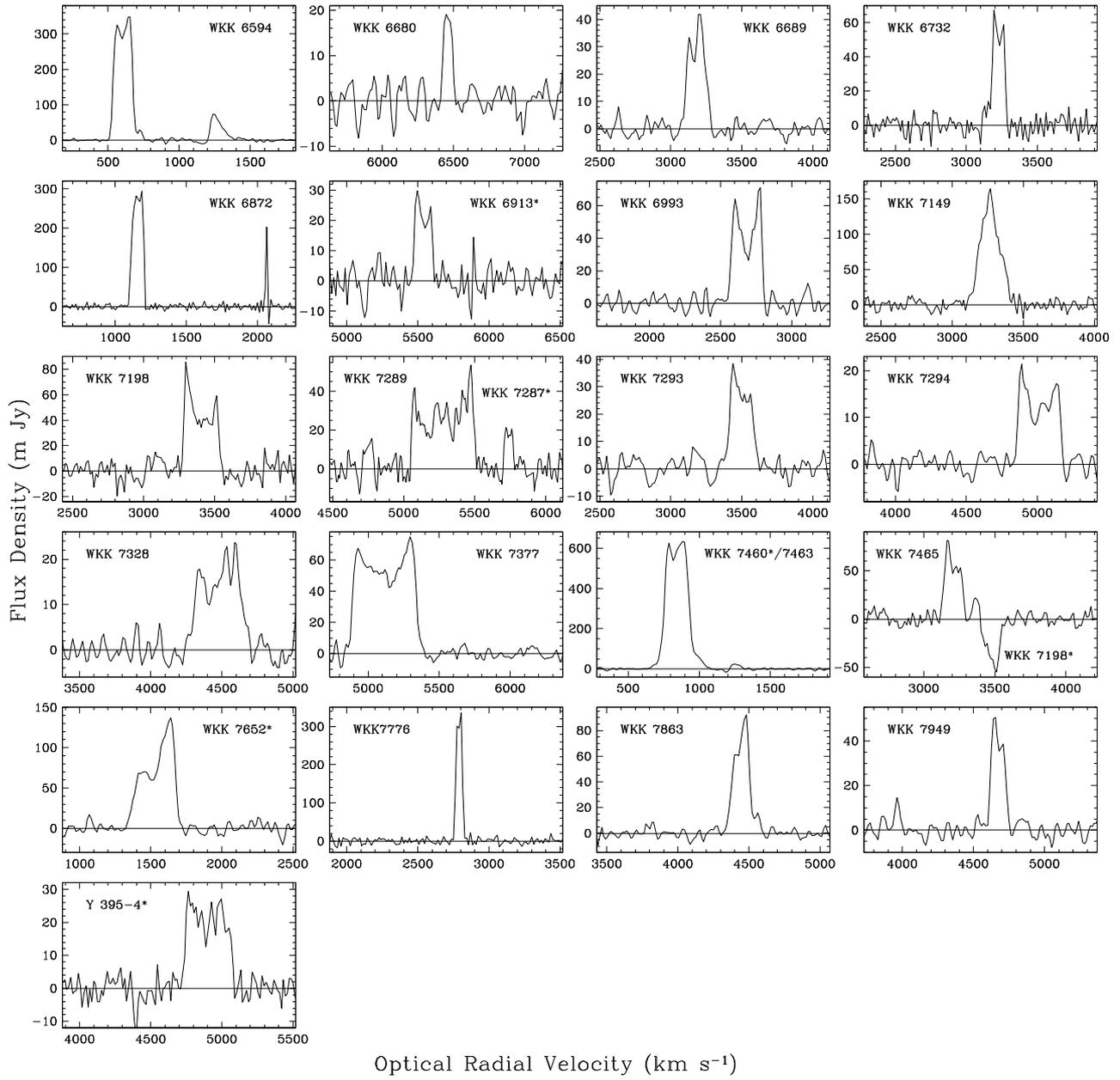


Fig. 1. continued.