Dust and CO emission towards the centers of normal galaxies, starburst galaxies and active galactic nuclei^{★,★★}

I. New data and updated catalogue

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Received 6 January 2004 / Accepted 27 October 2006

ABSTRACT

Aims. The amount of interstellar matter in a galaxy determines its evolution, star formation rate and the activity phenomena in the nucleus. We therefore aimed at obtaining a data base of the ¹²CO line and thermal dust emission within equal beamsizes for galaxies in a variety of activity stages.

Methods. We have conducted a search for the ¹²CO (1–0) and (2–1) transitions and the continuum emission at 1300 μ m towards the centers of 88 galaxies using the IRAM 30 m telescope (MRT) and the Swedish ESO Submillimeter Telescope (SEST). The galaxies are selected to be bright in the far infrared ($S_{100 \mu\text{m}} \geq 9$ Jy) and optically fairly compact ($D_{25} \leq 180''$). We have applied optical spectroscopy and IRAS colours to group the galaxies of the entire sample according to their stage of activity into three sub-samples: normal, starburst and active galactic nuclei (AGN). The continuum emission has been corrected for line contamination and synchrotron contribution to retrieve the thermal dust emission. For the latter we have determined the radio spectral indices of the individual sources and extrapolated the synchrotron emission corresponding to our millimeter beams to 1300 μ m.

Results. We present new observational data for the ¹²CO (1–0) and (2–1) transitions and the thermal dust emission at 1300 μ m for 88 galaxies. In conjunction with our previous data, the new observations are used to compile an updated catalogue for a total of 160 galaxies.

Key words. galaxies: abundances – galaxies: ISM – galaxies: spiral – radio continuum: galaxies – radio lines: galaxies

1. Introduction

Activity in galaxies is a rather common phenomenon. It happens foremost in the galactic centers and originates either from a starburst (SB) or an active galactic nucleus (AGN). By definition, a galaxy is active when it produces a high luminosity in a small volume, say, more than $10^{10} L_{\odot}$ from a region 100 pc across. But such a criterion is hard to apply observationally due to the distance of the galaxies, their general obscuration by dust and the poor resolution in the far infrared where the spectral energy distribution usually peaks.

Alternatively, one regards the efficiency for converting interstellar gas into luminosity as an indicator of activity. The mass of interstellar gas, M_{gas} , is a fundamental parameter that obviously has a great influence either on the rate of star formation or on the fueling rate of an AGN and it can, like the luminosity, in principle, readily be measured.

The ¹²CO luminosity is believed to measure the molecular gas content. Several studies indicate that the ratio of FIR-to-CO luminosity is enhanced in starbursts (Sanders et al. 1986) and in

interacting galaxies (Young et al. 1986; Solomon & Sage 1988; Combes et al. 1994), and is, on the average, twice as large for FIR-selected galaxies than for a volume limited sample (Sage 1993).

More than a decade ago, we also set out to investigate whether the ratio $L_{\text{IR}}/M_{\text{gas}}$ is indeed a proper discriminator for activity. To make the analysis more trustworthy, we employed as an additional and independent tracer of the gas mass the millimeter dust continuum. Moreover, we used both millimeter ¹²CO lines and aimed at determining the dust and ¹²CO emission in identical beams directed towards the galactic centers. An important by-product of such an approach was the extension of the continuum spectral energy distribution to millimeter wavelengths and the derivation of the dust temperature of the coldest interstellar component.

We present new observations of the ¹²CO (1–0) and (2–1) transition and 1300 μ m continuum emission measurements. The new data are tabulated together with our old ones in order to present an updated and coherent catalogue. In the following sections, we describe the observational setups, the data reduction and how the galaxies are classified according to their activity stage. We show the new ¹²CO spectra and the corresponding line parameters. Furthermore, we list the 1300 μ m continuum flux densities. A detailed analysis of the data will be given elsewhere (Albrecht et al. in prep).

* Based on observations collected at ESO, La Silla, Chile, and IRAM, Pico Veleta, Spain.

** Appendices A and B are only available in electronic form at <http://www.aanda.org>

2. Galaxy sample

This paper is a continuation of our previous efforts (Chini et al. 1995, 1996; Krügel et al. 1990, and references therein) in a comparative study of two samples of galaxies. The galaxies of both samples are *a)* bright in the far infrared with IRAS flux densities $S_{100\ \mu\text{m}} \gtrsim 9$ Jy and *b)* optically fairly compact with major optical axes $D_{25} \leq 180''$. Note that because of misclassifications, we had to remove 4 objects from the original lists: UGC 3490 is a galactic H II region, ESO 494-G1 and ESO 430-N22 are galactic reflection nebulae and NGC 4634 is a dwarf galaxy.

The members of the first sample were all Markarian Galaxies. By the very way they were selected by Markarian (blue compact core, emission lines), they should be active in some way. The second sample was originally named Inactive or Normal because we thought that its 113 members were all inactive or normal spiral galaxies. Later it turned out that among them there are 24 H II galaxies, 7 Seyfert galaxies and 7 LINERS. The 47 Markarian Galaxies comprise 18 H II galaxies, 12 starbursts, 3 LINERS and 14 Seyfert galaxies (note that galaxies may have multiple activity classifications).

As we wish to classify all objects according to their activity and as our two historical samples (Markarians and normal galaxies) do obviously not provide a reliable separation, we have reevaluated the activity status of all galaxies. The new classification is based on optical spectroscopy as acquired from the NASA/IPAC Extragalactic Database (NED)¹ and, if optical spectroscopy is not available, on IRAS colours.

The relation between IRAS flux densities and dust temperature components is still under debate; in many objects one faces a mixture of various heating sources (SB/AGN). Also the origin of the energetic photons can often not be determined because of the re-processing by dust grains. However, Coziol et al. (1998) found, although the scatter is large, that the IRAS colour $\alpha(60, 25)$, where $\alpha(\lambda_1, \lambda_2) = \log(S_{\lambda_1}/S_{\lambda_2})/\log(\lambda_1/\lambda_2)$, is a fair indicator of activity: starbursts are characterized by a colour $\alpha(60, 25)$ between -1.9 and -2.5 , inactive galaxies have $\alpha(60, 25) < -2.5$ and for AGNs $\alpha(60, 25) > -1.9$. A common colour combination is $\alpha(60, 25)$ versus $\alpha(25, 12)$. Galaxies of type Sy 1 with $\alpha(60, 25) > -1.9$ also have $\alpha(25, 12) < -1.5$ which separates them from type Sy 2. We apply these limits in those cases where no optical spectroscopy data are available.

We have revised the classification of all galaxies on the basis of the most recent results. Instead of the two historical samples (Markarians and normal galaxies), we now have three samples: AGN, starburst and normal spirals. In the new classification, memberships may have changed. For example, three Markarian Galaxies for which we did not find anything published concerning their activity (besides being listed in the Markarian catalogue) now belong to the normal spiral sample because we concluded that their activity should be very moderate.

Figure 1 shows the IRAS colour-colour-diagram of the new samples. Their overlap in the figure clearly shows that the IRAS colours do not always corroborate the optical classification.

Including our new observations (see below), we have altogether obtained ^{12}CO and/or $1300\ \mu\text{m}$ continuum measurements for 160 galaxies. Table A.1 lists the names, coordinates, IRAS spectral indices $\alpha(60, 25)$, optical classification with regard to

Fig. 1. IRAS colour-colour-diagram $\alpha(60, 25)$ vs. $\alpha(25, 12)$ showing the distribution of the normal, starburst and AGN sample. An open symbol denotes that the object was in the historical Markarian sample, a filled symbol that it was in the historical (inactive) normal galaxy sample. The horizontal dividing lines are drawn according to the classification of Coziol et al. (1998).

activity and morphological type of all galaxies for which we obtained ^{12}CO line and/or $1300\ \mu\text{m}$ continuum measurements. As the observations will be interpreted in the context of IRAS data, the measurements were pointed towards the positions of Fullmer & Lonsdale (1989) as given in Table A.1.

2.1. The AGN sample

The AGN sample comprises 24 galaxies of which 21 are classified as Seyferts (Sy 2: 16) and one as narrow emission line galaxy (NELG, ESO 244-G12). The remaining two objects (NGC 2532 and NGC 4418), although no optical observations indicating the existence of an AGN have been reported, are included because of their IRAS colours ($\alpha(60, 25) > -1.9$). Although of the 22 galaxies optically classified as AGN, only 7 or 32% have $\alpha(60, 25) > -1.9$, this does not invalidate the flux ratio $\alpha(60, 25)$ as an activity indicator, it only shows that the relation is crude. Indeed, the average colour of all AGN is -2.2 and thus falls into the starburst range of Fig. 1, but only four sources (MRK 1034, MRK 1183, MRK 1066 and MRK 273) have colours typical of normal spiral galaxies.

2.2. The starburst sample

The sample of starburst galaxies contains 85 objects of which 56 show spectroscopic (optical) signs of enhanced activity: 42 H II galaxies, 12 starbursts and 10 LINERS (note that an object may have two classification tags). The IRAS colours $\alpha(60, 25)$ of the remaining 29 galaxies without optical classification lie between -1.9 and -2.5 . Of the 56 galaxies with optical activity, 41 also have $\alpha(60, 25)$ values typical of starbursts.

2.3. The normal spiral sample

The normal spiral sample contains all galaxies which show neither spectroscopic signs of starburst activity, nor of an AGN nor

¹ This research has made use of the NASA/IPAC Extragalactic Database (NED) which is operated by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration.

colours $\alpha(60, 25)$ above -2.5 . There are altogether 51 objects, among them are 3 Markarian galaxies.

3. Observations and data reduction

3.1. CO lines

The ^{12}CO (1–0) and (2–1) line transitions were observed at the IRAM 30 m telescope (MRT) between 1996 and 1998 and at the Swedish ESO Submillimetre Telescope (SEST) in 1997.

At the MRT, we used the 1 mm and 3 mm SIS receivers simultaneously with beam sizes of $24''$ and $12''$, respectively. The secondary mirror was wobbled at 0.5 Hz with an amplitude of $\pm 120''$. We adopted a main beam efficiency of 0.68 at 115 GHz, and of 0.41 at 230 GHz. Towards six galaxies (MRK 281, MRK 297, MRK 323, MRK 759, MRK 928 and NGC 2532), we have obtained five-point raster maps with a spacing of $22''$ in RA and Dec. For NGC 5713, a hexagonal seven-point raster map was acquired where all points have a radial spacing of $22''$ from the center position.

At the SEST, the beams sizes at these frequencies were $45''$ and $24''$ and the respective main beam efficiencies appropriate for point sources were 0.71 and 0.51. The dual channel 115/230 GHz SIS receiver was used. The beam separation was $11'45''$ in azimuth in dual beam switching mode.

All spectra were reduced using the CLASS² software package (Buisson et al. 1997).

3.2. 1300 μm continuum

The continuum observations at the MRT were performed in March 1997 with the MPIfR 19-channel-bolometer array and in February 1998 with the MPIfR 37-channel-bolometer array, always with $11''$ spatial resolution. The beam separation was $70''$ in azimuth to avoid contamination of the reference beam by flux from the outer parts of the galaxy (see Chini et al. 1995, for observing details). The continuum data have been reduced using NIC².

At the SEST, the continuum observations were carried out in 1997 using a single channel bolometer of the MPIfR. A dual beam switching mode with a separation of $120''$ was applied (see Albrecht et al. 2004).

4. Results

4.1. CO lines

We obtained new ^{12}CO line observations towards 22 galaxies at the MRT (normal: 2, starburst: 17, AGN: 3), and towards 27 galaxies at the SEST (normal: 11, starburst: 14, AGN: 2). Together with our previous observations, we now have ^{12}CO data for a total of 130 galaxies (normal: 40, starburst: 70, AGN: 20). The single-beam spectra from the MRT and the SEST are shown in Fig. B.1 (MRT, spirals), Fig. B.2 (MRT, MRK) and Fig. B.3 (SEST, spirals). The five-point raster maps from the MRT are displayed in Fig. B.4 to Fig. B.9 and the seven-point raster map towards NGC 5713 is shown in Fig. B.10. Line parameters and the velocity-integrated ^{12}CO intensities are given in Table A.2. In some cases, a decomposition into two or even three Gaussians was necessary and then the fit parameters for all components are listed; I_{CO} always refers to the total of all components. New data are typed boldface.

² CLASS and NIC are part of the GILDAS software. The manual can be retrieved via the IRAM web-page.

Fig. 2. Velocity-integrated ^{12}CO (1–0) intensities of the three galaxy samples as a function of absolute projected beam-radius. When a galaxy has been observed both at the SEST and the MRT, the data points are connected by a straight line.

Fig. 3. Velocity-integrated ^{12}CO (2–1) intensities of the three galaxy samples as a function of absolute projected beam-radius. Data points from SEST and MRT are connected by a straight line.

Figures 2 and 3 show the velocity-integrated intensities of the ^{12}CO (1–0) and (2–1) transitions as a function of the galactic radius as determined by the linear size of the telescope beam, r_{beam} , at the distance of the galaxy. No trend is discernible in Fig. 2 among the galaxy types. However, in cases where a galaxy has been observed with different beam-sizes, data points are connected by a solid line and in these sources the molecular emission is clearly concentrated towards the center (the only exception being UGC 2627). It is also evident that for small radii the gradient is, on average, steeper than for large radii. Though less pronounced, similar conclusions hold for the (2–1) transition (Fig. 3) where the spatial resolution is twice as high. In most cases, I_{CO} again decreases with r_{beam} , however, in four starburst galaxies (MRK 1088, MRK 769, MRK 332 and NGC 1482) it rises. A likely explanation would be molecular rings or bars. Two

normal spirals (NGC 935 and again UGC 2627) have a nearly flat radial gradient.

For fixed radial intervals, there is a general trend that starburst galaxies have, on average, higher values of I_{CO} than normal galaxies, while AGN are intermediate.

4.2. 1300 μm continuum

We observed the 1300 μm continuum towards 56 sources (normal: 15, starburst: 34, AGN: 7) and detected 42 with a signal-to-noise ratio $S/N \geq 3$ (normal: 11, starburst: 25, AGN: 6). For 23 of them, we also obtained new ^{12}CO data. The 1300 μm flux densities are given in Table A.3 together with the 1σ statistical error of the measurement. The absolute errors due to systematic uncertainties and including calibration are greater and typically amount to 20%. New data are typed boldface. Combined with the data already published, our new catalogue contains 1300 μm continuum measurements towards the centers of 148 galaxies (normal: 45, starburst: 80, AGN: 23).

4.3. Contamination of $S_{1300\mu\text{m}}$ by line emission

The 1300 μm bolometers have a bandwidth of roughly 50 GHz and the continuum flux densities therefore are affected by contamination of the ^{12}CO (2–1) line. Following Braine et al. (1995), we calculated the ratio of line-over-total flux density for those galaxies where we simultaneously obtained 1300 μm continuum and ^{12}CO (2–1) line measurements with the same beam-size (for details on the procedure see also Albrecht et al. 2004). The resulting values from both telescopes are shown in Fig. 4 as a function of r_{beam} . For a few galaxies, the ^{12}CO (2–1) line contributions could be determined simultaneously from MRT and SEST data; in these cases, the corresponding values are connected by straight lines. The highest line contribution is found towards MRK 281 (79%) and MRK 799 (58%), but usually the values stay below 30%. The least contaminated is UGC 2627 (1% in an $11''$ beam).

Mean values and standard deviations are given in Table 1. As evident from Fig. 4, the scatter is large. The line contribution is greatest in starburst galaxies, normal spirals have mean values about 9% lower, while AGN are intermediate in their average, but with a large scatter. Whenever possible, we correct the 1300 μm continuum flux by subtracting the integrated ^{12}CO (2–1) line flux. If line and continuum measurements do not refer to the same beam, we use, when possible, the value that applies to a smaller or bigger beam. If ^{12}CO (2–1) data are absent altogether, we take the mean of the sample (normal, starburst, AGN) according to Table 1. This procedure is possible as the bolometers at the MRT and the SEST have the same bandwidth of 50 GHz and therefore the line contamination from different instruments can be mixed. The corrected continuum flux densities S_{cont} at 1300 μm are listed in Table A.3.

4.4. Contamination of S_{cont} by synchrotron radiation

In active galaxies, synchrotron radiation may contribute significantly at 1300 μm . Unfortunately, synchrotron emission is time-variable and the measurements at cm and mm wavelengths refer to different epochs, and usually also to different beam sizes. To estimate the synchrotron contribution, we searched the literature and databases for radio fluxes. When we found measurements at two or more distinct wavelengths, we determined the radio spectral index α from $S_\nu \sim \nu^\alpha$, neglecting any contribution from

Table 1. Mean and standard deviation of the ^{12}CO (2–1) line contribution to the 1300 μm flux density in %.

sample	line contamination	number of galaxies
normal	15.7 ± 8.2	27
starburst	24.4 ± 12.7	58
AGN	19.0 ± 13.5	14
total	21.3 ± 12.3	99

Fig. 4. ^{12}CO (2–1) line contribution to the 1300 μm continuum measurements versus absolute projected beam-radius. Lower limits are denoted by arrows. In case the line contribution has been determined simultaneously at the SEST and the MRT the values are connected by straight lines.

free-free emission. This was possible for 109 galaxies (normal: 29, starburst: 61, AGN: 19). The α -values are given in Table A.3 together with references to the radio data. When there was only a measurement at one wavelength, we adopted a standard spectral index of $\alpha = -0.7$. For the normal spiral ESO 346-G22, the radio data by Condon et al. (1998) and Mauch et al. (2003) yield $\alpha = 0.53$. We disregarded this extreme spectral index as Condon et al. 1998 report a high peak flux density residual, and assumed $\alpha = -0.7$ instead.

Extrapolating the radio data towards 1300 μm , we obtain the synchrotron flux from the galaxy within the radio beam. As the millimeter beam resolves the galaxy, this result is most likely an overestimate of the synchrotron contribution. To account for this effect, we have estimated the fraction of the total synchrotron emission within the mm beam ($11''$, $24''$ and/or $70''$). For this purpose, we use – where available – the deconvolved Gaussian fit parameters from the NRAO VLA Sky Survey (NVSS, Condon et al. 1998) at 1.4 GHz, the Parkes MIT NRAO (PMN) Surveys (Wright et al. 1994, 1996; Griffith et al. 1994, 1995) at 4.85 GHz, the 1.425 GHz Atlas of the IRAS bright galaxy sample (Condon et al. 1996) or the Sydney University Molonglo Sky Survey (SUMSS, Mauch et al. 2003) at 843 MHz.

We restricted this procedure to cases where the projected distance between mm observation and fit position is $\leq 20''$. Likely cases of confusion with neighbouring radio sources were also rejected. In three cases, where confusion could be excluded we allowed for larger projected distances up to $35''$.

The contribution of the synchrotron emission to the total continuum flux, scaled to the mm beam, is shown in Fig. 5. For the majority of galaxies, the contamination is

Fig. 5. Synchrotron contribution to the continuum flux density. Upper and lower limits are denoted by arrows. Data points referring to the same galaxy are connected by straight lines.

Table 2. Mean and standard deviation of the synchrotron contribution to the 1300 μm continuum flux density in %.

Sample	Synchrotron contamination	Number of galaxies
normal	2.4 ± 3.5	55
starburst	6.1 ± 7.2	88
AGN	7.8 ± 15.2	21
total	5.1 ± 8.0	164

Fig. 6. Thermal dust emission at 1300 μm . Upper limits are denoted by arrows. Corresponding data points are connected by straight lines.

less than 10%. Only in the composite starburst/AGN galaxy NGC 7130 (Levenson et al. 2005) does the radio flux within 24'' when extrapolated to 1300 μm , exceed the observed value. We attribute this to variability in this extremely active object. A very high contribution of 68% is also found in MRK 231, an ultraluminous infrared galaxy, which is also the only known OH megamaser galaxy classified as Seyfert 1 (Richards et al. 2005).

Mean values and standard deviations for the synchrotron contribution are given in Table 2 where NGC 7130 has been excluded from the determination. As already apparent from Fig. 5,

the scatter is large. For 8 galaxies no Gaussian fit parameters are available and, as for NGC 7130, the corresponding mean values are used.

4.5. Thermal dust emission

After subtraction of the line and synchrotron contribution one obtains the pure thermal dust emission for which flux densities, S_{dust} , are given in Table A.3. Of course, as the synchrotron contribution is variable, the corrections may not apply to the epoch of the mm observations. However, the contamination is in most galaxies well below 10% and possible variations would affect the resulting dust emission only marginally.

The dust emission is shown in Fig. 6 as a function of r_{beam} . The data exhibit an increase with radius that is larger at smaller radii (note that r_{beam} is given in logarithmic scale). As for the ^{12}CO emission, this indicates that, on average, the dust displays a strong central concentration.

Acknowledgements. We wish to thank Dr. R. Lemke for providing ^{12}CO data for a couple of galaxies during the Swedish observing time at the SEST. We acknowledge the help of Dr. A. Sievers who reduced part of the 1300 μm data. This research has made use of the VizieR catalogue access tool, CDS, Strasbourg, France.

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Online Material

Appendix A: Tables**Table A.1.** The galaxy sample.

Name	RA	Dec	$\alpha(60, 25)$	Optical classification	Morphological type
	(B1950.0)				
		normal			
MRK 582	01 55 31.0	+02 50 33	-2.55		SBm
MRK 1405	03 40 38.1	+39 08 14	-3.03		S0 ⁻ :
MRK 1134	23 44 30.5	+29 11 44	-2.69		I0:
NGC 0834	02 08 00.3	+37 25 55	-2.46		S?
NGC 0877	02 15 15.2	+14 18 37	-3.20		SAB(rs)bc
NGC 0935	02 25 23.9	+19 22 22	-2.85		Scd:
NGC 1134	02 50 57.1	+12 48 42	-2.66		S?
UGC 02627	03 13 55.7	+31 23 16	-2.75		SA(s)c
UGC 02936	04 00 12.3	+01 49 39	-2.51		SB(s)d
ESO 118-G16	04 15 36.0	-60 19 40	-2.58		SAB(r)b
NGC 2339	07 05 24.9	+18 51 36	-2.51		SAB(rs)bc
ESO 492-G2	07 09 38.9	-26 37 15	-2.66		SA(r)b
NGC 2276	07 10 11.5	+85 50 53	-2.68		SAB(rs)c
NGC 2397	07 21 29.6	-68 54 17	-2.52		SAB(rs)b
ESO 493-G16	07 46 39.0	-26 07 11	-2.63		Sb-c
NGC 2640	08 36 05.1	-54 56 51	-2.88		SA0 ⁻
ESO 563-G28	08 48 31.9	-21 46 35	-2.80		SBa: pec
NGC 2706	08 53 40.4	-02 22 15	-2.59		Sbc? sp
ESO 61-G11	09 37 32.4	-69 51 56	-2.81		S
NGC 2967	09 39 29.3	+00 33 58	-2.67		SA(s)c
ESO 500-G34	10 22 10.0	-23 17 59	-2.55		(R ₁)SB(s)0/a
ESO 317-G23	10 22 31.5	-39 03 12	-3.12		(R' ₁)SB(rs)a
NGC 3278	10 29 23.6	-39 41 58	-2.57		SA(s)c?
NGC 3366	10 32 58.4	-43 25 58	-2.85		SB(rs)bc
ESO 093-G03	10 57 33.0	-66 03 54	-2.80		SAB(r)0/a:
NGC 3655	11 20 17.6	+16 51 50	-2.59		SA(s)c:
NGC 3800	11 37 37.6	+15 37 08	-2.71		SAB(rs)b: pec
NGC 3882	11 43 36.9	-56 06 32	-2.67		SB(s)bc
NGC 3987	11 54 46.2	+25 28 24	-2.85		Sb
NGC 4041	11 59 38.8	+62 24 53	-2.62		SA(rs)bc:
NGC 4746	12 49 24.7	+12 21 14	-2.52		Sb: sp
NGC 4808	12 53 15.9	+04 34 32	-2.62		SA(s)cd:
NGC 4900	12 58 05.8	+02 46 12	-2.81		SB(rs)c
NGC 5145	13 23 03.8	+43 31 28	-2.72		S?
NGC 5156	13 25 41.4	-48 39 31	-2.61		SB(r)bc
NGC 5313	13 47 36.0	+40 13 56	-2.87		Sb?
NGC 5480	14 04 30.4	+50 57 46	-2.53		SA(s)c:
NGC 5600	14 21 25.8	+14 51 53	-2.55		Sc pec
ESO 272-G14	14 28 27.2	-43 11 55	-2.68		(R')SA:(s)bc
ESO 272-G23	14 36 55.4	-44 06 14	-3.04		Sc? sp
NGC 5719	14 38 22.6	-00 06 19	-2.67		SAB(s)ab pec
ESO 223-G12	15 05 49.9	-52 21 54	-2.97		SA(s)bc?sp
NGC 6215	16 46 47.2	-58 54 32	-2.73		SA(s)c pec
ESO 282-G03	18 57 28.1	-45 23 05	-2.75		SA(s)c
NGC 6753	19 07 11.5	-57 07 57	-2.90		(R')SA(r)b
NGC 6796	19 20 50.8	+61 02 53	-2.58		Sbc: sp
NGC 6824	19 42 36.3	+55 59 18	-2.56		SA(s)b:
M+04-48-2	20 26 26.3	+25 33 53	-2.69		S
ESO 467-G27	22 11 49.6	-27 42 51	-2.60		(R')SA(rs)bc
ESO 346-G22	22 56 39.3	-37 58 18	-2.59		SB(rs)cd
NGC 7448	22 57 34.4	+15 42 48	-2.91		SA(rs)bc

Table A.1. continued.

Name	RA (B1950.0)	Dec	$\alpha(60, 25)$	Optical classification	Morphological type
starburst					
MRK 545	00 07 19.3	+25 38 47	-2.38	H II, SB	SB(s)a
MRK 555	00 43 32.5	-01 59 47	-1.53	SB	SA(rs)b pec?
MRK 1021	02 06 56.7	-10 22 21	-2.82	LINER	SAB(r)ab: pec
MRK 1022	02 07 10.5	-10 23 02	1.74	SB	SA(rs)0 ⁰ pec:
MRK 1027	02 11 28.4	+04 56 29	-2.47		I?
MRK 603	03 06 25.6	-03 08 43	-1.93	H II	S0 ⁻ pec:
MRK 1088	04 52 01.5	+03 11 14	-2.32	SB	(R)SB(s)0/a:
MRK 1093	05 05 19.8	-08 05 02	-2.24	H II	(R')SB(rs)a pec
MRK 1194	05 09 06.6	+05 08 24	-2.56	SB	SB0
MRK 1199	07 20 29.6	+33 32 23	-1.89	H II	Sc
MRK 708	09 39 34.1	+04 54 09	-2.24	H II	SBc
MRK 404	09 39 55.7	+32 04 36	-2.49	H II	SAB(r)bc
MRK 158	10 56 02.3	+61 47 54	-2.25	H II	Sa
MRK 188	11 44 54.4	+56 14 41	-2.66	SB	SAB(rs)c
MRK 1466	12 05 37.4	+03 09 26	-1.83	SB	SB(r)c
MRK 759	12 08 04.8	+16 18 38	-2.36	H II, SB	SAB(rs)c
MRK 201	12 11 41.3	+54 48 10	-1.89	H II	IBm pec
MRK 439	12 22 08.1	+39 39 31	-2.42	H II	(R)SA(rs)a
MRK 769	12 22 53.0	+16 44 51	-2.42	H II	Sa? pec
MRK 281	13 55 00.4	+42 05 20	-2.41	SB	(R')SB(rs)b:pec
MRK 799	13 59 08.4	+59 34 12	-2.11	H II, SB	SB(s)b
MRK 1490	14 17 53.8	+49 27 54	-2.26	H II, LINER	Sa
MRK 848	15 16 19.0	+42 55 40	-2.08		S0? pec
MRK 297	16 03 01.4	+20 40 37	-2.39		Sc+Sc
MRK 496	16 10 24.0	+52 35 04	-1.95	H II	Sd pec
MRK 1116	17 36 38.3	+86 46 42	-2.46	H II	S?
MRK 928	23 15 47.5	-04 41 21	-2.28	H II	Sab? P
MRK 323	23 17 54.3	+27 02 27	-2.56	H II, SB	SBc
MRK 538	23 33 39.9	+01 52 35	-1.59	H II, LINER	SB(s)b:pec
MRK 332	23 56 51.8	+20 28 17	-2.36	SB	SBc
NGC 232	00 40 17.5	-23 50 02	-2.54	H II	SB(r)a? pec
UGC 00556	00 52 07.8	+28 58 27	-2.92	LINER	S?
UGC 00903	01 19 06.6	+17 19 52	-2.97	H II	S?
NGC 0633	01 34 11.1	-37 34 28	-3.34	H II	(R')SAB:(rs)b
NGC 0643B	01 38 25.3	-75 15 45	-2.44		SB0?
ESO 3-G7	02 03 08.6	-84 13 40	-2.41		SAB(rs)c: pec
NGC 0992	02 34 35.8	+20 53 06	-2.42		S?
NGC 1482	03 52 25.8	-20 38 54	-2.19	H II	SA0+ pec sp
UGC 02982	04 09 43.3	+05 25 12	-2.68	H II	Sm
UGC 03094	04 32 38.3	+19 04 07	-2.34		Sbc
ESO 485-G3	04 37 00.9	-24 16 52	-2.54	H II	Sb:
NGC 1637	04 38 57.2	-02 57 12	-2.02		SAB(rs)c
UGC 03356	05 44 15.9	+17 32 42	-2.03		Sbc
UGC 03608	06 53 52.7	+46 28 11	-2.20	H II	S pec
UGC 03630	06 58 27.4	+01 58 57	-2.30		SAB(r)b?
NGC 2342	07 06 20.5	+20 43 04	-1.99	H II	S pec
ESO 491-G20	07 07 46.5	-27 29 14	-2.16		SB(rs)b: pec
ESO 163-G11	07 36 58.1	-55 04 31	-2.50		SB(s)b? sp
ESO 126-G02	09 12 15.8	-60 34 56	-2.05	H II	(R' ₂)SB(rs)ab
ESO 126-G03	09 13 23.6	-60 13 35	-2.20		SB(rs)bc
ESO 91-G16	09 36 57.5	-63 15 37	-2.46		Sb? sp
NGC 3021	09 47 58.8	+33 47 20	-2.20		SA(rs)bc:
NGC 3067	09 55 26.1	+32 36 32	-2.50	H II	SAB(s)ab?
NGC 3177	10 13 48.6	+21 22 24	-2.47		SA(rs)b
NGC 3318	10 35 03.7	-41 22 08	-2.49		SAB(rs)b

Table A.1. continued.

Name	RA (B1950.0)	Dec	$\alpha(60, 25)$	Optical classification	Morphological type
starburst (continued)					
NGC 3437	10 49 52.8	+23 12 04	-0.26		SAB(rs)c:
ESO 264-G57	10 56 44.8	-43 10 18	-2.28		SA(rs)bc
NGC 3504	11 00 28.5	+28 14 27	-1.87	H II	(R)SAB(s)ab
NGC 3949	11 51 05.1	+48 08 15	-2.82	H II	SA(s)bc:
NGC 4273	12 17 22.3	+05 37 17	-2.44		SB(s)c
NGC 4575	12 35 09.0	-40 15 48	-2.49		SAB(rs)bc
NGC 4750	12 48 19.4	+73 08 50	-2.96	LINER	(R)SA(rs)ab
NGC 5104	13 18 49.2	+00 36 15	-2.63	LINER	Sa:
ESO 509-G54	13 30 07.9	-23 57 04	-2.41		S?
NGC 5258	13 37 22.2	+01 05 13	-2.37	H II, LINER	SA(s)b: pec
ESO 221-G32	14 08 53.3	-49 09 22	-2.50		SA(r)c
NGC 5653	14 28 00.2	+31 26 17	-2.39	H II	(R')SA(rs)b
NGC 5665	14 29 57.4	+08 17 59	-2.43	H II	SAB(rs)c pec?
NGC 5713	14 37 37.1	-00 04 34	-2.40	H II	SAB(rs)bc pec
NGC 5786	14 55 40.3	-41 48 51	-2.33		(R' ₂)SAB(s)bc
NGC 5915	15 18 47.6	-12 54 49	-2.38		SB(s)ab pec
NGC 5962	15 34 13.8	+16 46 16	-2.64	H II	SA(r)c
NGC 5990	15 43 44.7	+02 34 11	-2.02		(R')Sa pec?
NGC 6000	15 46 44.1	-29 14 08	-2.30	H II	SB(s)bc:
NGC 6181	16 30 10.1	+19 55 49	-2.45	H II	SA(rs)c
NGC 6156	16 30 28.2	-60 30 55	-2.29		(R' ₁)SAB(rs)c
UGC 11041	17 53 04.5	+34 46 59	-2.42	H II	Sab
ESO 140-IG10	18 09 20.2	-57 44 28	-2.22	H II	Sd
NGC 6808	19 38 30.8	-70 45 02	-2.41		SA(r)ab pec:
NGC 6918	20 27 15.4	-47 38 33	-2.23	H II	(R)SAB(rs)a
ESO 286-G35	21 00 52.5	-43 47 32	-2.48		S
NGC 7083	21 31 50.0	-64 07 33	-3.12	LINER	SAB(rs)c
ESO 405-G05	22 13 12.9	-37 05 39	-2.51	H II	SA(rs)bc
ESO 602-G25	22 28 42.8	-19 17 31	-2.34	LINER	SA(r)b
NGC 7769	23 48 31.0	+19 52 18	-2.39	H II, LINER	(R)SA(rs)b
AGN					
MRK 938	00 08 33.3	-12 23 10	-2.25	Sy 2	Sc
MRK 1034	02 20 23.6	+31 58 09	-2.57	Sy 1	
MRK 1183	02 39 51.0	+28 21 41	-2.74	Sy	Sa
MRK 1066	02 56 50.1	+36 37 21	-5.06	Sy 2	(R)SB(s)0 ⁺
MRK 1073	03 11 43.3	+41 51 02	-2.01	Sy 2	(R')SB(s)b
MRK 617	04 31 35.5	-08 40 42	-1.70	Sy 2	SB(s)c pec
MRK 620	06 45 37.5	+60 54 13	-1.76	Sy 2	SB(r)a:
MRK 231	12 54 04.7	+57 08 39	-1.57	Sy 1	SA(rs)c? pec
MRK 266	13 36 14.1	+48 31 53	-2.25	Sy 2	Pec
MRK 273	13 42 51.6	+56 08 14	-2.65	Sy 2	Ring galaxy
MRK 1376	14 10 38.9	-02 58 28	-1.01	Sy 1.9	Sa pec sp
MRK 533	23 25 24.7	+08 30 14	-1.22	Sy 2	SA(r)bc pec
MRK 534	23 26 13.8	+03 14 14	-2.13	Sy 2	SB0 pec:
MRK 331	23 48 52.9	+20 18 20	-2.22	Sy 2	S?
ESO 244-G12	01 15 56.9	-44 43 26	-1.83	NELG	Sb: pec
NGC 2532	08 07 04.1	+34 06 17	-1.89		SAB(rs)c
NGC 4418	12 24 22.1	-00 36 14	-1.74		(R')SAB(s)a
ESO 381-G08	12 38 10.2	-36 28 52	-1.31	Sy 2	SB(rs)bc:
NGC 4785	12 50 36.7	-48 28 46	-2.34	Sy 2	(R')SAB(r)ab
NGC 5427	14 00 48.3	-05 47 25	-2.35	Sy 2	SA(s)c pec
NGC 6574	18 09 35.1	+14 58 05	-2.46	Sy	SAB(rs)bc:
NGC 7130	21 45 19.7	-35 11 04	-2.34	Sy 2	Sa pec
NGC 7172	21 59 07.0	-32 06 42	-2.32	Sy 2	Sa pec sp
NGC 7590	23 16 09.7	-42 30 48	-2.48	Sy 2	S(r?)bc

Table A.2. ^{12}CO line parameters. The central velocity v with respect to the local standard of rest and the full width at half maximum dv are given in km s^{-1} , the peak main beam brightness temperature T_{mb} is given in mK and the velocity-integrated intensity I_{CO} in K km s^{-1} . New data boldface.

Name	$^{12}\text{CO (1-0)}$								$^{12}\text{CO (2-1)}$							
	MRT (24'')				SEST (45'')				MRT (12'')				SEST (24'')			
	v	dv	T_{mb}	I_{CO}	v	dv	T_{mb}	I_{CO}	v	dv	T_{mb}	I_{CO}	v	dv	T_{mb}	I_{CO}
	normal															
NGC 0834	4570	231	88	28.1					4589	223	168	46.7				
	4704	79	77						4701	64	100					
NGC 0877	3862	143	80	12.2	3870	342	32	11.6	3871	132	92	12.9	3865	213	46	10.4
NGC 0935	4055	86	135	12.4	4084	256	25	6.8	4078	82	87	7.6	4085	172	41	7.5
NGC 1134	3482	169	107	41.6	3489	277	29	13.5	3504	189	166	44.3	3539	471	71	35.6
	3687	236	89		3720	144	32		3715	151	68					
UGC 02627	4150	35	72	2.7	4159	179	24	4.6	4143	34	52	1.9	4097	54	32	1.8
UGC 02936	3721	130	106	36.0	3644	136	21	16.4	3719	119	164	38.5	3792	226	82	19.7
	3869	193	104		3792	338	37		3865	165	101					
ESO 118-G16					1107	130	49	6.8					1121	144	86	13.2
NGC 2339	2162	123	134	47.2	2122	113	49	15.3	2172	126	240	66.6	2121	88	79	22.6
	2320	164	170		2295	173	51		2328	149	217		2265	179	80	
ESO 492-G2					2447	118	20	4.6					2439	81	57	15.2
					2635	95	21						2562	193	50	
NGC 2276	2440	36	470	18.0					2440	31	430	14.2				
NGC 2397					1337	251	54	14.4					1315	121	76	9.8
ESO 493-G16					2568	170	87	21.9					2648	214	88	20.0
					2719	71	82									
NGC 2640					985	106	15	4.2					1001	115	31	10.1
					1229	169	14						1243	237	25	
ESO 563-G28					2468	131	32	9.8								
					2646	146	34									
NGC 2706					1594	235	24	6.0					1629	178	64	12.1
NGC 2967					1828	34	90	9.3					1839	31	74	5.3
					1887	69	82						1879	35	77	
ESO 500-G34					3655	278	15	4.4					3571	114	63	15.4
													3736	178	41	
ESO 317-G23					2686	298	30	9.5					2627	229	40	19.9
													2802	212	45	
NGC 3278					2840	60	38	5.9					2969	205	33	7.2
					2983	157	21									
NGC 3366					2855	364	13	5.0								
ESO 093-G03					1841	225	18	4.3								
NGC 3655					1419	82	50	9.9								
					1570	116	45									
NGC 3800	3216	206	91	20.0	3217	84	30	7.9	3197	174	104	19.3				
					3397	222	22									
NGC 3882					1879	100	73	7.8					1864	123	82	10.7
NGC 3987	4350	350	100	37.3	4470	455	36	17.4					4417	402	99	42.4
NGC 4746					1779	239	18	4.6								
NGC 4808	784	104	102	11.3	759	165	35	6.2	798	91	110	10.7	819	86	72	6.7
NGC 4900	980	42	163	7.3	972	51	97	5.3	979	42	161	7.2	976	35	108	4.0
NGC 5156					2968	145	52	8.0					2956	160	75	12.8
NGC 5600					2317	50	92	4.9								
ESO 272-G14					1965	108	100	11.5					1981	98	95	9.9
ESO 272-G23					2906	194	21	4.3								
NGC 5719	1730	400	100	42.6	1743	361	28	10.8	1730	400	95	40.4				
ESO 223-G12					1478	205	27	5.9								
NGC 6215					1556	40	236	10.0					1565	44	235	11.0
ESO 282-G03					5083	269	25	7.2								

Table A.2. continued.

Name	¹² CO (1–0)								¹² CO (2–1)							
	MRT (24'')				SEST (45'')				MRT (12'')				SEST (24'')			
	<i>v</i>	<i>dv</i>	<i>T_{mb}</i>	<i>I_{CO}</i>	<i>v</i>	<i>dv</i>	<i>T_{mb}</i>	<i>I_{CO}</i>	<i>v</i>	<i>dv</i>	<i>T_{mb}</i>	<i>I_{CO}</i>	<i>v</i>	<i>dv</i>	<i>T_{mb}</i>	<i>I_{CO}</i>
normal (continued)																
NGC 6753					2990	64	73	13.9					2998	90	95	9.1
ESO 467-G27					3247	255	33									
					5386	132	28	7.1								
ESO 346-G22					5200	212	14									
					1292	56	28	1.7					1260	159	41	6.9
NGC 7448					2205	205	27	5.9					2237	139	37	5.5
starburst																
MRK 545	4447	141	47	16.9	4456	190	20	8.9	4443	129	45	18.8	4657	210	33	7.4
MRK 1022	4641	201	46		4688	152	30		4628	211	56					
	3816	196	71	21.5	3870	247	34	8.9	3825	151	77	25.6	3884	230	64	15.7
	3914	77	81						3897	102	122					
MRK 603							<10									
MRK 1088	4528	216	32	13.4	4644	325	8	2.8	4518	91	13	8.0	4572	92	46	12.2
	4737	153	37						4713	148	43		4714	173	42	
MRK 1093	4463	180	63	18.7	4538	253	24	6.5	4468	217	86	31.5	4348	129	47	14.6
	4602	93	67						4604	92	119		4505	136	56	
MRK 1194	4379	79	128	22.8	4387	151	29	9.6	4373	88	325	40.8	4405	148	86	21.8
	4538	70	162		4553	124	37		4471	66	148		4568	94	82	
MRK 1199	4077	37	62	2.4					4067	50	48	2.5				
MRK 708	2063	197	144	30.2	2067	192	26	5.3	2081	191	74	15.0	2070	204	28	6.1
MRK 404	1376	152	130	24.9					1361	161	47	16.0				
	1439	32	113						1437	47	158					
MRK 158	2142	126	201	27.0					2117	140	201	30.0				
MRK 188	2307	65	118	22.8					2306	71	72	23.2				
	2425	154	89						2410	162	103					
	1318	120	139	17.8	1319	114	50	6.1	1329	113	271	32.6	1324	97	90	9.3
MRK 759	2107	30	66	9.3					2102	28	115	13.0				
	2175	121	56						2171	140	64					
MRK 201	2558	149	104	16.5					2560	170	282	52.7				
MRK 769	1689	89	76	7.2	1700	214	11	2.5	1708	101	40	4.3	1714	117	51	6.4
MRK 281	2219	147	180	38.5					2237	138	286	47.8				
	2363	64	152						2357	52	104					
MRK 799	2897	173	159	49.8					2882	117	304	82.7				
	3076	101	191						3070	152	277					
	7750	136	74	10.7					7751	138	207	30.4				
MRK 1490	12087	93	84	8.3					12091	110	124	14.5				
MRK 848	4739	123	125	16.4					4741	122	190	24.7				
MRK 297	7882	258	76	20.9												
MRK 1116	7361	258	63	17.3					7346	266	135	38.2				
MRK 928	4227	105	78	18.5					4240	129	103	29.0				
MRK 323	4359	84	109						4353	70	200					
MRK 538	2799	173	38	7.0	2848	93	18	1.8	2808	81	28	2.4				
MRK 332	2403	64	355	24.2	2401	84	65	18.7	2405	67	262	5.8	2400	71	162	12.2
NGC 232	6664	162	85	38.2	6814	433	25	11.5	6672	178	140	51.3	6667	88	65	17.8
	6883	277	80						6873	253	92		6901	183	60	
UGC 00556					4595	373	15	6.0								
UGC 00903	2417	133	47	22.7	2395	220	15	8.0	2500	138	220	32.3	2433	174	44	14.3
	2514	189	80		2580	202	21						2625	145	40	
NGC 0633					5152	141	30	4.5								
NGC 0643B					3917	226	33	7.9					3819	127	68	16.2
													3954	152	43	
ESO 3-G7					3539	74	80	6.3					3494	79	124	10.4

Table A.2. continued.

Name	¹² CO (1–0)								¹² CO (2–1)							
	MRT (24'')				SEST (45'')				MRT (12'')				SEST (24'')			
	<i>v</i>	<i>dv</i>	<i>T_{mb}</i>	<i>I_{CO}</i>	<i>v</i>	<i>dv</i>	<i>T_{mb}</i>	<i>I_{CO}</i>	<i>v</i>	<i>dv</i>	<i>T_{mb}</i>	<i>I_{CO}</i>	<i>v</i>	<i>dv</i>	<i>T_{mb}</i>	<i>I_{CO}</i>
starburst (continued)																
NGC 0992	3991	67	131	31.0	3998	60	30	6.9	3992	78	204	16.9	3977	41	61	12.4
	4118	245	83		4131	233	20						4007	295	31	
NGC 1482	1916	158	135	32.1	1887	259	84	23.2	1902	185	93	33.4	1938	183	184	35.8
	1992	59	149						1983	86	165					
UGC 02982	5192	148	94	35.6	5182	185	30	9.9	5188	140	84	38.0	5209	178	35	18.3
	5395	168	116		5392	110	34		5369	205	117		5413	148	74	
UGC 03094					7239	482	15	7.7					6982	113	32	12.4
													7184	334	24	
ESO 485-G3					4523	305	19	6.2					4332	70	33	8.9
													4476	223	27	
NGC 1637					732	124	60	7.9					736	98	100	10.4
UGC 03356	5507	196	70	14.6	5453	285	18	5.5	5499	220	112	26.2	5385	397	20	8.5
UGC 03630	1692	125	203	62.3	1629	85	40	13.4	1678	109	216	63.1	1663	110	111	27.1
	1841	129	257		1776	199	46		1825	133	269		1804	117	113	
NGC 2342	5149	92	69	24.6	5186	265	25	7.1	5202	175	115	33.2	5248	262	47	13.1
	5325	204	82						5367	118	94					
ESO 491-G20	2953	90	75	14.6	3003	192	32	6.5	2953	130	112	29.9	3063	299	24	7.6
	3063	123	57						3093	114	110					
ESO 163-G11					2715	131	26	6.8					2772	192	44	12.7
					2879	92	32						2868	119	29	
ESO 126-G02					2886	116	44	5.4					2909	126	95	12.7
ESO 126-G03					2928	245	26	6.8					2893	165	73	12.8
ESO 91-G16					2000	202	27	5.8					1996	160	63	10.7
NGC 3021					1505	226	21	5.1								
NGC 3067					1535	105	49	5.5								
NGC 3177	1269	115	211	40.2	1256	93	67	12.4	1289	125	198	47.0	1305	127	81	14.6
	1371	53	254		1370	56	97		1372	48	404		1374	37	93	
NGC 3318					2792	267	17	4.8								
NGC 3437	1289	147	83	18.3	1207	221	27	9.7	1299	186	74	17.9	1305	312	25	12.4
	1375	68	74		1365	77	41		1375	58	52		1382	46	84	
NGC 3504					1465	60	100	20.3								
					1580	119	110									
NGC 4273	2329	89	98	20.7	2380	225	37	8.9	2335	76	125	23.2				
	2429	120	89						2407	134	92					
NGC 5104					5456	361	16	6.2								
ESO 509-G54	4787	152	101	32.3	4705	153	40	11.5	4786	148	173	46.6				
	4970	119	126		4898	114	41		4970	117	155					
NGC 5258					6787	279	11	3.3								
ESO 221-G32					2885	85	87	7.9					2876	90	93	8.9
NGC 5653					3451	88	55	9.9								
					3586	178	25									
NGC 5665	2219	136	72	10.4	2227	177	34	6.4	2230	164	80	14.0	2211	169	45	8.1
NGC 5713	1913	100	509	54.2	1909	104	191	21.1	1913	101	709	76.2	1915	95	376	38.0
NGC 5786					2938	244	30	7.8								
NGC 5915					2277	122	27	3.5					2272	139	51	7.6
NGC 5962					2004	340	35	12.7					2110	80	65	5.5
NGC 5990	3760	232	91	36.7	3798	350	28	10.4	3750	202	83	30.6	3886	295	26	8.2
	3961	134	100						3950	143	84					
NGC 6000					2136	212	94	21.2					2154	250	117	31.1
NGC 6181					2373	275	37	10.8					2429	237	58	14.6
NGC 6156					3263	182	71	13.8					3249	213	136	30.8
UGC 11041	4700	90	122	42.1	4772	202	27	8.6	4695	107	128	42.5	4713	159	34	10.4
	4863	260	110		4979	102	26		4887	200	131		4913	119	37	

Table A.2. continued.

Name	¹² CO (1–0)								¹² CO (2–1)							
	MRT (24'')				SEST (45'')				MRT (12'')				SEST (24'')			
	<i>v</i>	<i>dv</i>	<i>T_{mb}</i>	<i>I_{CO}</i>	<i>v</i>	<i>dv</i>	<i>T_{mb}</i>	<i>I_{CO}</i>	<i>v</i>	<i>dv</i>	<i>T_{mb}</i>	<i>I_{CO}</i>	<i>v</i>	<i>dv</i>	<i>T_{mb}</i>	<i>I_{CO}</i>
starburst (continued)																
ESO 140-IG10					5044	68	24	5.7					5103	299	49	15.6
					5182	183	21									
NGC 6808					3354	139	41	9.3					3277	54	53	9.9
					3537	138	22						3359	196	33	
NGC 7083					3187	70	66	13.5					3120	251	34	9.1
					3304	107	75									
ESO 405-G05					3296	166	51	20.2					3350	216	151	50.9
					3480	150	70						3500	111	137	
ESO 602-G25					7462	215	17	6.5					7495	208	42	16.3
					7698	165	15						7706	164	40	
NGC 7769					4232	245	38	9.9					4261	226	58	14.0
AGN																
MRK 938	5731	149	46	17.0	5798	274	23	6.7	5740	172	143	56.5	5875	271	15	4.3
	5891	198	45						5910	184	155					
MRK 1034	9943	107	46	26.4					10003	172	62	44.5				
	10166	229	51						10261	219	105					
	10364	100	82						10378	70	116					
MRK 1183	1521	156	48	11.2					1540	175	65	14.2				
	1637	72	42						1649	43	45					
MRK 1066	3592	143	74	19.3					3576	129	172	47.2				
	3725	128	59						3695	156	142					
MRK 1073	6912	87	80	15.3					6921	90	97	17.4				
	7063	151	49						7067	153	50					
MRK 617	4682	41	45	14.9	4700	139	27	9.2	4659	41	11	3.3	4652	117	79	29.9
	4829	173	70		4818	148	33		4839	175	15		4798	173	109	
MRK 620	1746	144	59	22.4					1835	247	27	18.3				
	1914	172	73						1958	73	144					
MRK 231	12647	186	88	17.4					12652	194	250	51.6				
MRK 273	11266	244	49	19.8					11285	201	61	19.8				
	11526	229	29						11495	199	32					
MRK 1376	1758	127	40	18.3	1984	183	12	2.3	1754	91	22	9.0				
	1969	139	87						1952	161	40					
ESO 244-G12					6658	275	21	6.3					6741	201	67	14.3
NGC 2532	5195	40	230	20.8	5163	102	65	7.1	5189	34	311	23.1				
	5246	97	107						5244	110	101					
NGC 4418					2123	112	25	3.0								
ESO 381-G08					3216	82	17	2.6					3228	170	31	8.9
					3318	46	23						3343	59	52	
NGC 4785					3714	504	17	9.1								
NGC 5427					2715	136	55	8.0								
NGC 6574					2250	236	62	15.6					2246	188	47	9.4
NGC 7130					4830	85	163	14.7					4872	96	187	19.1
NGC 7172					2289	216	22	15.8					2016	127	13	11.1
					2659	439	23						2327	418	21	
NGC 7590					1553	259	26	7.2					1507	205	45	9.8

Table A.3. Results of the continuum observations. New data boldface.

Name	$S_{1300\ \mu\text{m}}$ [mJy]			S_{cont} [mJy]			S_{dust} [mJy]			α_{radio}	Ref.
	MRT	SEST		MRT	SEST		MRT	SEST			
	11''	24''	70''	11''	24''	70''	11''	24''	70''		
normal											
MRK 582	<9.3			<7.8			<7.8			−0.79	1
MRK 1405	6.7 ± 0.8			5.7			5.5			−0.77	2,11
MRK 1134	<8.4			<7.1			<6.9				1
NGC 0834	19.3 ± 3.4			15.5			15.4			−0.94	2, 6
NGC 0877	14.0 ± 4.2	27.0 ± 5.3	105 ± 12.3	13.0	23.0	93.3	13.0	22.8	92.5	−0.84	2, 5
NGC 0935		21.4 ± 5.6			18.5			18.5		−1.21	2, 8
NGC 1134	21.3 ± 6.7	43.9 ± 9.0	142 ± 16.7	17.7	30.2	108.0	17.5	29.7	107.0	−0.82	2, 5
UGC 02627	11.4 ± 3.1	<25.2		11.2	<24.5		11.2	<24.5		−0.91	1,11
UGC 02936		26.5 ± 5.8	80 ± 11.5	18.9	57.0		18.5	56.2			2
ESO 118-G16		20.8 ± 3.7			15.7			15.6			9
NGC 2339	19.4 ± 2.4	35.3 ± 5.9	138 ± 13.6	14.0	26.6	102.0	13.9	26.2	101.0	−0.93	2, 5
NGC 2276	17.6 ± 4.8			16.5			16.4			−0.76	2,11
NGC 2397		35.4 ± 6.1	94 ± 12.9		31.6	83.9		31.3	83.0		9
ESO 493-G16		26.1 ± 5.1			18.4			14.3		−0.48	2,12
NGC 2640		42.9 ± 6.1			39.0			37.4		−0.76	10
NGC 2706	7.3 ± 0.6			6.2			6.0				2
ESO 61-G11		25.4 ± 7.9			21.4				21.1		9
NGC 2967	<9.0	16.3 ± 4.5		<7.9	14.2		<7.6	13.1		−0.27	2,14
ESO 500-G34	10.9 ± 1.8			9.2			8.2			−0.46	2,13
ESO 317-G23		50.6 ± 7.4			42.9			41.9			2
NGC 3655	10.7 ± 0.9			9.0			9.0			−0.99	2, 8
NGC 3800	15.4 ± 2.1	15.3 ± 4.4		13.8	13.8		13.4	12.7		−0.59	2, 8
NGC 3882		40.3 ± 7.7	116 ± 15.1		36.2	104		29.7	97.5		3
NGC 3987	23.3 ± 2.8			19.6			19.4				2
NGC 4041	18.7 ± 4.5			15.8			15.4			−0.61	2, 5
NGC 4746	10.9 ± 1.0			9.2			9.2			−0.99	2, 8
NGC 4808	5.6 ± 1.4	14.4 ± 3.6		4.7	11.9		4.7	11.9		−1.09	2, 8
NGC 4900	<5.2	<13.2		<4.6	<11.7		<4.6	<11.6		−0.71	2, 8
NGC 5145	4.9 ± 0.8			4.1			4.0			−0.56	2,11
NGC 5313	<5.6			<4.7			<4.6			−0.74	2, 7
NGC 5480	10.7 ± 3.6			9.0			8.9			−0.67	2,11
NGC 5600	<21.6			<18.2			<17.9			−0.54	2, 8
ESO 272-G14		55.5 ± 8.4	146 ± 22.0		51.7	136		48.7	128.0	−0.56	3, 4
ESO 272-G23		<23.4			<19.7			<19.2			
NGC 5719	16.1 ± 1.2	32.5 ± 9.5		12.8	25.9		12.4	24.9			2
ESO 223-G12		45.1 ± 10.3			38.0			37.1			
NGC 6215		35.8 ± 3.8	128 ± 12.1		31.5	113		31.3	111.0	−0.68	3, 9
ESO 282-G03		29.5 ± 7.4	49 ± 9.8		24.9	41.3		24.3	40.3		
NGC 6753		44.6 ± 4.8	124 ± 10.8		41.1	114.0		40.8	113.0	−0.91	3, 9
NGC 6796	15.3 ± 3.5			12.9			12.7			−0.53	2,11
NGC 6824	17.3 ± 2.9			14.6			14.3			−0.70	2,11
M+04-48-2	14.3 ± 3.4	38.6 ± 9.0	81 ± 12.9	12.1	32.5	68.3	11.9	31.5	66.2		2
ESO 467-G27		17.9 ± 5.5	38 ± 8.9		15.1	32.0		14.6	30.8		2
ESO 346-G22		11.4 ± 3.8	78 ± 10.6		8.7	59.7		8.7	59.5	0.53 ^a	2, 9
NGC 7448	11.8 ± 1.8	32.9 ± 7.0	90 ± 12.3	11.0	30.8	84.2	11.0	30.7	83.7	−0.92	2, 6
starburst											
MRK 545	5.9 ± 1.5			4.4			4.3			−1.18	1
MRK 555	<5.7			<4.3			<4.1			−0.53	1
MRK 1021	6.2 ± 2.6			4.7			4.7			−2.10	1
MRK 1022	6.0 ± 1.4			3.9			3.7			−0.74	1, 2
MRK 1027	<10.2			<7.7			<7.7			−1.46	1
MRK 603	26.6 ± 2.4			20.1			19.9			−0.90	1

Table A.3. continued.

Name	$S_{1300\ \mu\text{m}}$ [mJy]			S_{cont} [mJy]			S_{dust} [mJy]			α_{radio}	Ref.
	MRT	SEST		MRT	SEST		MRT	SEST			
	11''	24''	70''	11''	24''	70''	11''	24''	70''		
starburst (continued)											
MRK 1088	5.8 ± 1.5			5.2			4.9			-0.66	1, 2
MRK 1093	7.0 ± 2.2			4.5			4.1			-0.53	1, 2
MRK 1194	18.7 ± 3.1			15.4			15.3			-0.94	1
MRK 1199	<3.9			<3.7			<3.6			-0.55	2, 8
MRK 708	5.2 ± 1.5			4.0			3.6			-0.61	1
MRK 404	5.1 ± 0.9			3.8			3.8			-1.14	1
MRK 158	9.3 ± 1.5			6.9			6.2			-0.32	1
MRK 188	6.1 ± 1.5			4.2			3.6			-0.35	1
MRK 1466	7.4 ± 0.9			4.8			4.0			-0.35	1
MRK 759	<3.3			<2.3			<2.3			-2.57	1
MRK 201	9.1 ± 1.3			5.0			4.1			-0.58	1
MRK 439	5.8 ± 1.4			4.4			4.2				1
MRK 769	6.7 ± 2.0			6.4			6.3			-1.22	1
MRK 281	4.9 ± 1.2			1.0			1.0			-0.88	1
MRK 799	11.6 ± 2.0			4.9			4.8			-0.87	1
MRK 1490	8.4 ± 1.1			5.9			5.8			-0.70	1
MRK 848	7.6 ± 1.2			6.4			6.4			-1.69	1
MRK 297	10.4 ± 1.4			8.4			8.3			-1.40	1
MRK 496	8.2 ± 0.9			6.2			6.1			-1.13	1
MRK 1116	4.1 ± 1.0			3.1			3.1			-0.95	1
MRK 928	6.7 ± 2.1			3.6			2.8			-0.62	1
MRK 323	<14.4			<12.1			<12.1			-1.45	1
MRK 538	<11.1			<10.9			<10.6			-0.57	1, 2
MRK 332	<6.6			<6.1			<5.7			-0.50	1, 2
NGC 232		30.3 ± 4.0	48 ± 5.7		23.4	37.1		22.3	35.5	-0.06	2
UGC 00556		<16.2			<12.2			<11.4			2
UGC 00903		38.5 ± 5.8			33.0			32.3			2
NGC 0633		12.7 ± 3.3			9.6			9.6		-1.35	2, 9
NGC 0643B		29.4 ± 7.0			23.1			22.9			9
ESO 3-G7		27.6 ± 6.6			23.6			23.3			9
NGC 0992		14.7 ± 4.2			9.9			7.4		-0.59	2, 6
NGC 1482	11.0 ± 2.7	72.3 ± 8.2	143 ± 15.7	8.3	58.5	112	5.3	48.3	92.8	-0.47	2, 3
UGC 02982	13.1 ± 1.8	39.6 ± 5.1	55 ± 11.8	10.0	32.6	43.6	9.9	32.2	43.0	-0.98	2, 12
UGC 03094	10.9 ± 2.0	38.1 ± 9.0		9.5	33.3		9.4	32.9		-0.93	2, 5
ESO 485-G3		14.5 ± 3.7			11.1			10.1		-0.67	2, 13
UGC 03356		<51.6			<48.3			<48.1			2
UGC 03608	12.8 ± 1.3			9.7			9.3			-0.75	2, 6
UGC 03630	16.2 ± 2.0	27.2 ± 5.6	81 ± 13.4	11.1	16.7	52.6	9.7	12.2	43.7	-0.37	2, 6
NGC 2342	11.9 ± 4.0	44.0 ± 8.8	103 ± 15.9	9.2	38.9	85.4	9.0	38.3	84.1	-0.81	2, 5
ESO 491-G20		26.2 ± 5.0			23.2			22.6			2
ESO 126-G02		33.1 ± 5.9			28.2			26.5			
ESO 126-G03		13.0 ± 4.5			8.1			7.6			
ESO 91-G16		21.3 ± 5.6			17.2			16.2			
NGC 3021	3.6 ± 0.8			2.7			2.7			-1.06	2, 8
NGC 3067	11.9 ± 1.9			9.0			8.7				2
NGC 3177	18.6 ± 2.0	30.7 ± 4.5		14.8	25.1		14.7	24.9		-0.99	2, 8
NGC 3437	10.6 ± 1.5			9.2			8.9			-0.61	2, 6
ESO 264-G57		26.3 ± 4.4			19.9			19.9		-1.16	4, 9
NGC 3504	22.0 ± 1.7			16.6			15.0			-0.70	2, 5
NGC 3949	<5.1			<3.9			<3.8			-0.96	2, 5
NGC 4273	11.9 ± 2.6			10.0			8.5			-0.36	2, 8
NGC 4575		30.1 ± 6.6			22.8			22.2			4

Table A.3. continued.

Name	$S_{1300\ \mu\text{m}}$ [mJy]			S_{cont} [mJy]			S_{dust} [mJy]			α_{radio}	Ref.
	MRT	SEST		MRT	SEST		MRT	SEST			
	11''	24''	70''	11''	24''	70''	11''	24''	70''		
starburst (continued)											
NGC 4750	5.1 ± 1.5			3.9			3.8			−0.70	2,11
ESO 509-G54	12.0 ± 3.4	<12.6		8.2	<8.6		8.1	<8.2		−0.89	2,13
NGC 5258	<7.5			<5.7			<5.7				2
ESO 221-G32		<23.4			<20.0			<18.8			9
NGC 5665	<4.8	15.7 ± 4.4		<3.7	12.6		<3.2	11.1		−0.52	2, 6
NGC 5713	17.1 ± 1.4	79.4 ± 12.0	158 ± 19.9	10.9	64.7	115	9.3	59.1	101.0	−0.43	2, 5
NGC 5786		40.6 ± 10.7			30.7			30.7		−1.88	4, 9
NGC 5915	8.1 ± 2.0	39.7 ± 7.1		7.5	36.8		6.5	34.2		−0.51	2,13
NGC 5962	11.0 ± 2.4	20.2 ± 6.0		9.8	18.1		9.7	17.7		−0.73	2, 5
NGC 5990	13.1 ± 3.0	19.9 ± 5.9		10.6	16.8		10.5	16.5		−0.98	2, 8
NGC 6000	42.7 ± 3.9	60.6 ± 7.8	122 ± 12.8	34.2	48.6	97.8	32.4	43.8	89.9	−0.58	2,12
NGC 6181	<12.0	19.7 ± 4.8		<8.6	14.1		<7.8	11.2		−0.43	2, 6
NGC 6156		42.1 ± 5.6	163 ± 16.7		30.2	117		27.0	114.0		3
UGC 11041	22.5 ± 3.4	<36.3		19.1	<32.3		19.0	<32.0		−0.94	2, 8
ESO 140-IG10		35.2 ± 5.2	82 ± 11.2		29.2	68.0		28.7	66.2		9
NGC 6808		20.5 ± 4.0	37 ± 11.3		16.7	30.1		16.5	29.3	−0.81	3, 9
NGC 6918		18.7 ± 5.4	45 ± 8.0		14.1	34.0		13.9	33.4		9
ESO 286-G35		25.4 ± 4.2			19.2			18.1			4
NGC 7083		22.4 ± 5.2	77 ± 10.1		18.9	65.0		18.7	64.0		9
ESO 405-G05		48.5 ± 3.9	185 ± 15.8		28.9	110		25.7	104.0	−0.61	2, 7
ESO 602-G25	22.0 ± 6.4	24.9 ± 4.2		16.4	18.6		16.0	17.4		−0.61	2,13
NGC 7769	6.0 ± 1.0			4.5			4.3			−0.62	2, 8
AGN											
MRK 938	9.7 ± 1.8			5.1			3.9			−0.47	1
MRK 1034	<9			<5.4			<5.4			−1.45	1
MRK 1183	9.6 ± 1.4			8.5			8.2			−0.54	1
MRK 1066	8.0 ± 1.2			4.2			3.3			−0.62	1
MRK 1073	12.0 ± 1.2			10.6			10.3			−1.07	1
MRK 617	10.9 ± 3.2			8.8			8.5			−0.61	1
MRK 620	12.3 ± 2.6			10.8			10.7			−1.29	1
MRK 231	40.0 ± 1.8			35.8			11.5			−0.34	1
MRK 266	10.1 ± 2.1			8.2			7.9			−0.85	1
MRK 273	19.8 ± 0.9			18.2			18.0			−1.32	1
MRK 1376	14.9 ± 1.0			14.2			12.8			−0.92	1
MRK 533	6.5 ± 2.1			5.3			5.2			−2.02	1
MRK 534	<4.5			<3.7			<3.5			−0.93	1
MRK 331	<8.7			<7.1			<6.7			−0.17	1
ESO 244-G12		21.6 ± 3.7			16.1			14.5			4
NGC 2532	<26.7			<21.6			<21.5			−0.68	2, 6
NGC 4418	43.3 ± 1.1			35.1			35.1				2
ESO 381-G08		16.9 ± 3.7			13.5			12.1			2
NGC 5427	5.1 ± 1.7			4.1			4.1			−0.79	2,14
NGC 6574	30.7 ± 5.4	41.9 ± 7.1	134 ± 15.7	28.0	38.3	122	27.7	37.5	121.0	−0.80	2, 6
NGC 7130		32.9 ± 4.3	101 ± 10.5		25.5	78.4		23.5	72.3	−0.29	2, 9
NGC 7172		34.2 ± 6.4	48 ± 7.7		29.9	42.0		29.1	40.6	−0.63	2, 9
NGC 7590		16.5 ± 3.3	86 ± 12.7		12.7	66.2		12.2	64.9		4

Notes: a: We do not consider this extreme value to be reliable (see text) and use the standard value instead. 1: Marx et al. (1994); 2: Condon et al. (1998); 3: Wright et al. (1994, 1996); Griffith et al. (1994, 1995); 4: Condon et al. (1996); 5: Becker et al. (1991); 6: Gregory & Condon (1991); 7: Vollmer et al. (2005); 8: Dressel & Condon (1978); 9: Mauch et al. (2003); 10: Sadler (1984); 11: de Bruyn et al. (1998); 12: Douglas et al. (1996); 13: de Breuck et al. (2002); 14: Haynes et al. (1975).

Appendix B: CO spectra

In the following we present all new spectra obtained at the MRT and the SEST.

Fig. B.1. ^{12}CO spectra of spirals from the MRT. The (1–0) lines (24'' resolution) are plotted solid black, the (2–1) lines (12'' resolution) dotted black. In these and all subsequent spectra the ordinate gives the main beam brightness temperature T_{mb} in units of K.

Fig. B.2. ^{12}CO spectra of MRK galaxies from the MRT. The (1–0) lines (24'' resolution) are plotted solid black, the (2–1) lines (12'' resolution) dotted black.

Fig. B.3. ^{12}CO spectra of spirals from the SEST. The (1–0) lines (45'' resolution) are plotted solid black, the (2–1) lines (24'' resolution) dotted black. Already published data are also displayed for comparison.

Fig. B.3. continued.

Fig. B.4. Five-point map of MRK 281. This and the following six figures are raster maps from the MRT in the ^{12}CO (1–0) line (24'' resolution, solid black) and the ^{12}CO (2–1) line (12'' resolution, dotted black). MRK 281 has a distance of $D = 30$ Mpc and an optical diameter of $D_{25} = 210''$. The E–W extent resembles the optical appearance of the galaxy which exhibits a double nucleus or a bar-like structure in its center.

Fig. B.3. continued.

Fig. B.5. Five-point raster map of MRK 297: $D = 63$ Mpc, $D_{25} = 48''$.

Fig. B.7. Five-point raster map of MRK 759: $D = 29$ Mpc, $D_{25} = 132''$.

Fig. B.6. Five-point raster map of MRK 323: $D = 63$ Mpc, $D_{25} = 60''$.

Fig. B.8. Five-point raster map of MRK 928: $D = 98$ Mpc, $D_{25} = 54''$.

Fig. B.9. Five-point raster map of NGC 2532: $D = 69$ Mpc, $D_{25} = 132''$.

Fig. B.10. Seven-point raster map of NGC 5713: $D = 25$ Mpc, $D_{25} = 198''$.