

Table A.1: All $z > 1$ CO Detections in the Literature ($1.06 \leq z \leq 2.56$)

Source	type	z	transition	I_{CO} (Jy kms $^{-1}$)	line FWHM (kms $^{-1}$)	telescope	refs.
SMM J02396-0134	SMG $_L$	1.062 ± 0.002	2-1	3.4 ± 0.3	780 ± 60	PdBI	1
MIPS J1428+3526	SB $_L$	1.3250 ± 0.0002	2-1	5.3 ± 1.2	386 ± 64	NMA/R	2
		1.3247 ± 0.0002	3-2	13.9 ± 4.8	386 ± 104	NMA/R	2
Q0957+561	QSO $_L$	1.4141	2-1	2.0	160/500	PdBI	3
			2-1	1.2 ± 0.1	160 ± 20	PdBI	4
					280 ± 50		
HR10	ERO	1.439	1-0	0.6 ± 0.1		VLA	5
		1.439 ± 0.001	2-1	1.4 ± 0.1	400	PdBI	6
		1.440 ± 0.001	5-4	1.35 ± 0.3	380	PdBI	6
3C 318	QSO	1.571	2-1	1.19 ± 0.22	200	PdBI	7
SMM J123549+6215	SMG	2.202	3-2	1.6 ± 0.2	600 ± 50	PdBI	8
			6-5	2.3 ± 0.4		PdBI	8
IRAS F10214+4724	QSO $_L$	2.2867 ± 0.0003	3-2	21 ± 5	200	12m	9
		2.28560 ± 0.00003	3-2	10.4		30m	10
		2.2855 ± 0.0003	3-2	4.1 ± 0.9	230 ± 30	30m	11
			3-2	4.4 ± 0.7	150	45m	12
		2.2858 ± 0.0002	3-2	7.5 ± 2.0	200	NMA	13,14
			3-2	3.5 ± 0.5		PdBI	15
		2.2853 ± 0.0003	3-2	4.8 ± 0.7	250 ± 15	OVRO	16
		2.2854 ± 0.0001	3-2	4.2 ± 0.8	220 ± 30	PdBI	17
		2.2855 ± 0.001	3-2	6.7 ± 1.4	170 ± 30	12m	18
		2.28582 ± 0.00002	4-3	15.5		30m	10
		2.2857 ± 0.0003	6-5	9.4 ± 2.0	240 ± 30	30m	11
SMM J16371+4053	SMG	2.380 ± 0.004	3-2	1.0 ± 0.2	830 ± 130	PdBI	1
SMM J163650+4057	SMG	2.3853 ± 0.0014	3-2	2.3 ± 0.2	840 ± 110	PdBI	19
		2.385	3-2	2.3 ± 0.3	710 ± 50	PdBI	8
		2.383	7-6	1.1 ± 0.2		PdBI	19
			7-6	6.7 ± 0.7		PdBI	8
53W002	RG	2.394 ± 0.001	3-2	1.5 ± 0.3	540 ± 100	OVRO	20
		2.3927 ± 0.0003	3-2	1.20 ± 0.15	420 ± 40	PdBI	21
SMM J163658+4105	SMG	2.450 ± 0.002	3-2	1.8 ± 0.3	870 ± 80	PdBI	1
		2.452	3-2	1.8 ± 0.2	800 ± 50	PdBI	8
			7-6	3.3 ± 0.5		PdBI	8
SMM J123707+6214	SMG	2.490	3-2	0.91 ± 0.09	430 ± 60	PdBI	8
SMM J044307+0210	SMG $_L$	2.5094 ± 0.0002	3-2	1.4 ± 0.2	350 ± 60	PdBI	19
		2.509	3-2	1.4 ± 0.2	650 ± 40	PdBI	8
			7-6	1.0 ± 0.3		PdBI	8
SMM J16359+6612 A	SMG $_L$	2.5168 ± 0.0003	3-2	1.2 ± 0.14	500 ± 100	OVRO	22
B			3-2	3.5 ± 0.12		OVRO	22
C			3-2	1.6 ± 0.13		OVRO	22
A		2.51740	3-2	1.67 ± 0.13	220 ± 50	PdBI	23
					220 ± 50		
B		2.51741	3-2	2.50 ± 0.12		PdBI	23
C		2.51744	3-2	1.58 ± 0.17		PdBI	23
B		2.51737	3-2	2.8 ± 0.2	310 ± 20	30m	24
B		2.51732	4-3	4.0 ± 0.4	340 ± 25	30m	24
B		2.51746	5-4	5.1 ± 0.5	295 ± 30	30m	24
B		2.51738	6-5	4.0 ± 0.5	340 ± 35	30m	24
A			7-6	3.3 ± 1.4		PdBI	23
B			7-6	2.5 ± 0.7		PdBI	23
Cloverleaf	QSO $_L$	2.5585 ± 0.0001	3-2	8.1	326 ± 25	PdBI	25
			3-2	14.4 ± 4.4	352 ± 81	BIMA	26
		2.5579	3-2	9.9 ± 0.6	362 ± 23	30m	27
		2.55784 ± 0.00003	3-2	13.2 ± 0.2	416 ± 6	PdBI	28
			4-3	21.1 ± 0.8	375 ± 16	30m	27
			5-4	24.0 ± 1.4	398 ± 25	30m	27
			7-6	47.3 ± 2.2		PdBI	27
		2.5582 ± 0.0003	7-6	41 ± 4	339 ± 21	OVRO	29
			7-6	50.1 ± 2.8	480 ± 35	PdBI	30
			7-6	38.4	450	PdBI	31

Table A.2: All $z > 1$ CO Detections in the Literature ($2.56 \leq z \leq 4.69$)

Source	type	z	transition	I_{CO} (Jy kms $^{-1}$)	line FWHM (kms $^{-1}$)	telescope	refs.
SMM J14011+0252	SMG $_L$	2.5653 ± 0.0003	3-2	2.4 ± 0.3	200 ± 40	OVRO	32
		2.5652 ± 0.0001	3-2	2.8 ± 0.3	190 ± 11	PdBI	33
		2.5651 ± 0.0002	7-6	3.2 ± 0.5	170 ± 30	PdBI	33
VCV J1409+5628	QSO	2.585 ± 0.001	3-2	2.4 ± 0.7	370 ± 60	OVRO	34
		2.5832 ± 0.0001	3-2	2.3 ± 0.2	311 ± 28	PdBI	35
			7-6	4.1 ± 1.0		PdBI	35
MG 0414+0534	QSO $_L$	2.639 ± 0.002	3-2	2.6	580	PdBI	36
MS1512-cB58	LBG $_L$	2.7265 ± 0.0005	3-2	0.37 ± 0.08	174 ± 43	PdBI	37
LBQS1230+1627B	QSO $_L$	2.741	3-2	0.80 ± 0.26	(tentative)	PdBI	38
RX J0911+0551	QSO $_L$	2.796 ± 0.001	3-2	2.9 ± 1.1	350 ± 60	OVRO	34
SMM J02399-0136	SMG $_L$	2.808 ± 0.002	3-2	3.0 ± 0.4	710 ± 80	OVRO	39
		2.8076 ± 0.0002	3-2	3.1 ± 0.4	1100	PdBI	40
SMM J04135+10277	QSO $_L$	2.846 ± 0.002	3-2	5.4 ± 1.3	340 ± 120	OVRO	34
Cosmic Eye	LBG $_L$	3.0740 ± 0.0002	3-2	0.50 ± 0.07	190 ± 24	PdBI	41
B3 J2330+3927	RG	3.094	4-3	1.3 ± 0.3	500	PdBI	42
SMM J22174+0015	SMG	3.099 ± 0.004	3-2	0.8 ± 0.2	780 ± 100	PdBI	1
MG 0751+2716	QSO $_L$	3.1999	3-2	4.6 ± 0.5	400 ± 50	PdBI	43
		3.200 ± 0.00014	4-3	5.96 ± 0.45	390 ± 38	PdBI	44
		3.1999	4-3	4.2 ± 0.7	390 ± 70	PdBI	43
			8-7	2.2 ± 0.7		PdBI	43
SMM J09431+4700	SMG $_L$	3.3460 ± 0.0001	4-3	1.1 ± 0.1	420 ± 50	PdBI	19
		3.346	4-3	1.1 ± 0.2	400 ± 45	PdBI	8
SMM J13120+4242	SMG	3.408 ± 0.004	1-0	0.42 ± 0.07	1040 ± 190	GBT	45
		3.408 ± 0.002	4-3	1.7 ± 0.3	530 ± 50	PdBI	1
TN J0121+1320	RG	3.520	4-3	1.2 ± 0.4	700	PdBI	46
6C1909+722	RG	3.532	4-3	1.62 ± 0.30	530 ± 70	PdBI	47
4C60.07	RG		1-0	0.24 ± 0.03		VLA	48
		3.791	4-3	2.50 ± 0.43	>1000	PdBI	47
4C41.17	RG	3.7958 ± 0.0008	4-3	1.8 ± 0.2	1000 ± 150	PdBI	49
APM 08279+5255	QSO $_L$		1-0	0.150 ± 0.045		VLA	50
			1-0	0.22 ± 0.05		VLA	51
		3.9122 ± 0.0007	1-0	0.152 ± 0.020	556 ± 55	GBT	52
			1-0	0.168 ± 0.015		VLA	53
			2-1	0.81 ± 0.18		VLA	50,53
		3.9114 ± 0.0003	4-3	3.7 ± 0.5	480 ± 35	PdBI	54
		3.9115 ± 0.001	4-3	3.7 ± 0.4	490 ± 60	30m	55
		3.9118 ± 0.0003	4-3	3.8 ± 0.4	470 ± 17	PdBI	55
		3.9113 ± 0.0008	6-5	7.3 ± 0.7	445 ± 40	30m	55
		3.9109 ± 0.0002	9-8	9.1 ± 0.8		PdBI	54
		3.9111 ± 0.0006	9-8	11.1 ± 2.2	480 ± 40	30m	55
		3.9119 ± 0.0003	9-8	12.5 ± 2.4	460 ± 22	PdBI	55
		3.9110 ± 0.0015	10-9	11.9 ± 2.4	480 ± 90	30m	55
		3.9110 ± 0.0015	11-10	10.4 ± 2.1	520 ± 50	30m	55
		PSS J2322+1944	QSO $_L$	4.1192 ± 0.0004	1-0	0.19 ± 0.08	200 ± 70
4.1173 ± 0.0003	1-0			0.165 ± 0.014	202 ± 17	GBT	52
4.1184 ± 0.0008	1-0			0.25 ± 0.06	184 ± 46	100m	52
	2-1			0.92 ± 0.30		VLA	56,57
4.1199 ± 0.0008	4-3			4.21 ± 0.40	375 ± 41	PdBI	58
BRI 1335-0417	QSO	4.1199 ± 0.0008	5-4	3.74 ± 0.56	273 ± 50	PdBI	58
			2-1	0.32 ± 0.06		VLA	59
			2-1	0.44 ± 0.06		VLA	60
		4.4074 ± 0.0015	5-4	2.8 ± 0.3	420 ± 60	PdBI	61
BRI 0952-0115	QSO $_L$	4.4337 ± 0.0006	5-4	0.91 ± 0.11	230 ± 30	PdBI	38
BR 1202-0725	QSO	4.6932 ± 0.0004	1-0	0.124 ± 0.012	329 ± 36	GBT	52
		4.6956 ± 0.0012	1-0	0.22 ± 0.06	522 ± 146	100m	52
			2-1	0.49 ± 0.05		VLA	60
			4-3	1.5 ± 0.3		PdBI	62
		4.695 ± 0.002	5-4	2.7 ± 0.41	220 ± 74	NMA	63
		$4.6916/4.6947$	5-4	2.4 ± 0.3	$190/350$	PdBI	62
		4.6915 ± 0.001	7-6	3.1 ± 0.86	$250-300$	30m	62

Table A.3: All $z > 1$ CO Detections in the Literature ($4.69 \leq z \leq 6.42$)

Source	type	z	transition	I_{CO} (Jy kms^{-1})	line FWHM (kms^{-1})	telescope	refs.
SDSS J0338+0021	QSO	5.0267 ± 0.0003	5–4	0.73 ± 0.09	500	PdBI	64
TN J0924-2201	RG	5.202 ± 0.001	1–0	0.087 ± 0.017	250–400	ATCA	65
		5.202	5–4	1.19 ± 0.27	200–300	ATCA	65
SDSS J0927+2001	QSO	5.7722 ± 0.0006	5–4	0.44 ± 0.07	610 ± 110	PdBI	66
		5.7722 ± 0.0006	6–5	0.69 ± 0.13	550 ± 150	PdBI	66
SDSS J1148+5251	QSO	6.418 ± 0.004	3–2	0.18 ± 0.04		VLA	67,68
		6.4189 ± 0.0006	6–5	0.73 ± 0.076	279	PdBI	69
		6.4192 ± 0.0009	7–6	0.64 ± 0.088		PdBI	69

Notes—An index L at the galaxy type indicates magnification by strong gravitational lensing.

References—(1) Greve et al. 2005; (2) Iono et al. 2006a; (3) Planesas et al. 1999; (4) Krips et al. 2005; (5) Greve et al. 2003; (6) Andreani et al. 2000; (7) Willott et al. 2007; (8) Tacconi et al. 2006; (9) Brown & Vanden Bout 1991; (10) Brown & Vanden Bout 1992a; (11) Solomon et al. 1992a; (12) Tsuboi & Nakai 1992; (13) Kawabe et al. 1992; (14) Sakamoto et al. 1992; (15) Radford et al. 1993; (16) Scoville et al. 1995; (17) Downes et al. 1995; (18) Radford et al. 1996; (19) Neri et al. 2003; (20) Scoville et al. 1997; (21) Alloin et al. 2000; (22) Sheth et al. 2004; (23) Kneib et al. 2005; (24) Weiss et al. 2005aa; (25) Barvainis et al. 1994; (26) Wilner et al. 1995; (27) Barvainis et al. 1997; (28) Weiss et al. 2003; (29) Yun et al. 1997; (30) Alloin et al. 1997; (31) Kneib et al. 1998; (32) Frayer et al. 1999; (33) Downes & Solomon 2003; (34) Hainline et al. 2004; (35) Beelen et al. 2004; (36) Barvainis et al. 1998; (37) Baker et al. 2004; (38) Guilloteau et al. 1999; (39) Frayer et al. 1998; (40) Genzel et al. 2003; (41) Coppin et al. 2007; (42) De Breuck et al. 2003a; (43) Alloin et al. 2007; (44) Barvainis et al. 2002; (45) Hainline et al. 2006; (46) De Breuck et al. 2003b; (47) Papadopoulos et al. 2000; (48) Greve et al. 2004; (49) De Breuck et al. 2005; (50) Papadopoulos et al. 2001; (51) Lewis et al. 2002a; (52) Riechers et al. 2006a; (53) Riechers et al. 2007a; (54) Downes et al. 1999; (55) Weiss et al. 2007; (56) Carilli et al. 2002a; (57) Carilli et al. 2003; (58) Cox et al. 2002; (59) Carilli et al. 1999; (60) Carilli et al. 2002b; (61) Guilloteau et al. 1997; (62) Omont et al. 1996; (63) Ohta et al. 1996; (64) Maiolino et al. 2007; (65) Klammer et al. 2005; (66) Carilli et al. 2007; (67) Walter et al. 2003; (68) Walter et al. 2004; (69) Bertoldi et al. 2003b.

Table A.4: All $z>1$ Detections of Dense Molecular Gas in the Literature

Source	type	z	transition	I_{CO} (Jy kms $^{-1}$)	line FWHM (kms $^{-1}$)	telescope	refs.
IRAS F10214+4724	QSO $_L$	2.2858 \pm 0.0002	HCN(1-0)	0.05 \pm 0.01	140 \pm 30	GBT	1
			HCN(4-3)	0.10 \pm 0.03	110 \pm 43	PdBI	2
SMM J16359+6612 B	SMG $_L$	2.5168	HCN(1-0)	0.032 \pm 0.008		VLA	3
Cloverleaf	QSO $_L$	2.5569 \pm 0.0006	HCN(1-0)	0.069 \pm 0.012		VLA	4
			HCN(4-3)	2.6 \pm 0.5	436 \pm 103	30m	5
			HCN(4-3)	<1.2 a		PdBI	4
			HCO $^+$ (1-0)	0.055 \pm 0.006		VLA	6
			HCO $^+$ (4-3)	0.80 \pm 0.12	414 \pm 75	PdBI	7
			CN(3-2)	1.37 \pm 0.17	666 \pm 97	PdBI	8
			CS(3-2)	0.09 \pm 0.02		VLA	9
			HCN(1-0)	0.015 \pm 0.005	177 \pm 80	VLA	10
			HCN(5-4)	0.98 \pm 0.12	440 \pm 59	PdBI	11
VCV J1409+5628	QSO	2.5832	HCN(1-0)	0.015 \pm 0.005	177 \pm 80	VLA	10
APM 08279+5255	QSO $_L$	3.9121	HCN(5-4)	0.85 \pm 0.10	400 \pm 40	PdBI	12
			HCO $^+$ (5-4)	0.87 \pm 0.13	490 \pm 80	PdBI	13
			HNC(5-4)	2.3 \pm 1.1	(blended) b	PdBI	14

Notes—An index L at the galaxy type indicates magnification by strong gravitational lensing. Redshifts without error bars are adopted from CO.

a This line was not confirmed and is currently considered not detected.

b Due to blending with another line, this detection is not entirely certain.

References—(1) Vanden Bout et al. 2004; (2) Riechers et al. 2008c, in prep.; (3) Gao et al. 2007; (4) Solomon et al. 2003; (5) Barvainis et al. 1997; (6) Riechers et al. 2006b; (7) Riechers et al. 2008a, in prep.; (8) Riechers et al. 2007a; (9) Riechers et al. 2008b, in prep.; (10) Carilli et al. 2005; (11) Wagg et al. 2005; (12) Weiss et al. 2007; (13) Garcia-Burillo et al. 2006; (14) Guelin et al. 2007.

Table A.5: All $z>1$ Detections of Millimeter Carbon Lines in the Literature

Source	type	z	transition	I_{CO} (Jy kms $^{-1}$)	line FWHM (kms $^{-1}$)	telescope	refs.
IRAS F10214+4724	QSO $_L$	2.2854	[CI](1-0)	11		30m	1
			[CI](1-0)	1.6 \pm 0.2	160 \pm 30	30m	2
			[CI](2-1)	55		30m	1
Cloverleaf	QSO $_L$	2.5578	[CI](2-1)	150		12m	1
			[CI](1-0)	3.6 \pm 0.4	430 \pm 46	30m	3
			[CI](1-0)	3.9 \pm 0.6	360 \pm 60	30m	2
			[CI](2-1)	5.2 \pm 0.3	368 \pm 25	PdBI	4
SMM J14011+0252	SMG $_L$	2.5653	[CI](1-0)	1.8 \pm 0.3	235 \pm 45	30m	2
APM 08279+5255	QSO $_L$	3.911	[CI](1-0)	0.93 \pm 0.13	386 \pm 67	PdBI	5
PSS J2322+1944	QSO $_L$	4.1199	[CI](1-0)	0.81 \pm 0.12	319 \pm 66	PdBI	6
BR 1202-0725N	QSO	4.6949	[CII]	6.8 \pm 1.1	240 \pm 50	SMA	7
SDSS J1148+5251	QSO	6.4189 \pm 0.0006	[CII]	4.1 \pm 0.5	350 \pm 50	30m	8

Notes—An index L at the galaxy type indicates magnification by strong gravitational lensing. Redshifts without error bars are adopted from CO.

References—(1) Brown & Vanden Bout 1992b; (2) Weiss et al. 2005b; (3) Barvainis et al. 1997; (4) Weiss et al. 2003; (5) Wagg et al. 2006; (6) Pety et al. 2004; (7) Iono et al. 2006b; (8) Maiolino et al. 2005.