Numerical values of experimental data on species densities presented in manuscripts:

Laser absorption spectroscopy for plasma-assisted thermochemical treatment I: applicability of the Beer-Lambert law and interpretation of spectroscopic data

and

Laser absorption spectroscopy for plasma-assisted thermochemical treatment II: impact of the carbon and water contaminants on a low-pressure N_2 - H_2 discharge

A V Pipa[1], A Puth[1,3], J Böcker[2], S M Jafarpour[2], A Dalke[2], H Biermann[2], J Röpcke[1], JH van Helden[1]

[1]Leibniz Institute for Plasma Science and Technology (INP), Felix-Hausdorff-Straße 2, 17489 Greifswald, Germany

[2]Institute of Materials Engineering, Technische Universität Bergakademie Freiberg, Gustav-Zeuner-Straße 5, 09599 Freiberg, Germany

[3]Department of Applied Physics, Eindhoven University of Technology, Postbus 513, 5600 MB Eindhoven, The Netherlands

E-mail: pipa@inp-greifswald.de

18 January 2023

Tables and table captions

Table 1: Species densities measured in spectral window a

time min	CH_4 1356.486 (10^{14}cm^3)	CH_4 1356.597 (10^{14}cm^3)	CH_4 averaged (10^{14}cm^3)	HCN 1356.708 (10^{14}cm^3)
0	1.21 ± 0.093	1.12 ± 0.090	1.17 ± 0.07	5.20 ± 0.39
5	1.27 ± 0.10	1.23 ± 0.097	1.25 ± 0.06	5.27 ± 0.33
10	1.13 ± 0.10	1.34 ± 0.10	1.23 ± 0.1	5.35 ± 0.33
15	1.12 ± 0.13	1.40 ± 0.14	1.25 ± 0.2	5.41 ± 0.41
19	1.27 ± 0.085	1.45 ± 0.12	1.35 ± 0.1	5.45 ± 0.30
24	1.18 ± 0.093	1.26 ± 0.097	1.22 ± 0.06	5.66 ± 0.41
29	1.11 ± 0.10	1.33 ± 0.12	1.21 ± 0.1	6.29 ± 0.39
35	1.21 ± 0.12	1.02 ± 0.22	1.14 ± 0.1	6.17 ± 0.48
40	1.32 ± 0.14	1.14 ± 0.14	1.23 ± 0.1	6.48 ± 0.41
45	1.10 ± 0.11	1.23 ± 0.11	1.16 ± 0.09	6.89 ± 0.46
–	– – – –	– – – –	– – – –	– – – –
57	– – – –	– – – –	– – – –	4.44 ± 0.36
61	– – – –	– – – –	– – – –	4.11 ± 0.26
65	– – – –	– – – –	– – – –	3.52 ± 0.21
72	– – – –	– – – –	– – – –	3.79 ± 0.25
77	– – – –	– – – –	– – – –	3.34 ± 0.20
84	– – – –	– – – –	– – – –	2.81 ± 0.26
89	– – – –	– – – –	– – – –	2.97 ± 0.18
98	– – – –	– – – –	– – – –	2.94 ± 0.21
109	– – – –	– – – –	– – – –	2.58 ± 0.20
118	– – – –	– – – –	– – – –	2.56 ± 0.15
130	– – – –	– – – –	– – – –	2.92 ± 0.18
142	– – – –	– – – –	– – – –	3.06 ± 0.29
152	– – – –	– – – –	– – – –	2.72 ± 0.24
165	– – – –	– – – –	– – – –	2.16 ± 0.12
200	– – – –	– – – –	– – – –	1.91 ± 0.16
240	– – – –	– – – –	– – – –	2.19 ± 0.15
–	– – – –	– – – –	– – – –	– – – –
262	1.60 ± 0.13	1.69 ± 0.11	1.65 ± 0.08	2.46 ± 0.18
268	1.38 ± 0.080	1.59 ± 0.16	1.45 ± 0.1	3.32 ± 0.28
272	1.46 ± 0.13	1.42 ± 0.10	1.44 ± 0.07	3.62 ± 0.25
277	1.26 ± 0.089	1.42 ± 0.16	1.32 ± 0.1	4.00 ± 0.33
282	1.44 ± 0.10	1.33 ± 0.084	1.38 ± 0.08	4.50 ± 0.27
287	1.24 ± 0.076	1.40 ± 0.15	1.30 ± 0.10	5.19 ± 0.38
291	1.34 ± 0.12	1.25 ± 0.090	1.29 ± 0.07	4.81 ± 0.31
296	1.43 ± 0.10	1.30 ± 0.11	1.37 ± 0.09	5.69 ± 0.42
301	1.46 ± 0.13	1.36 ± 0.17	1.42 ± 0.09	5.24 ± 0.37
305	1.40 ± 0.14	1.35 ± 0.12	1.37 ± 0.07	6.22 ± 0.39
310	1.50 ± 0.13	1.38 ± 0.16	1.45 ± 0.10	6.93 ± 0.50
315	1.39 ± 0.17	1.59 ± 0.16	1.49 ± 0.1	6.16 ± 0.35
–	– – – –	– – – –	– – – –	– – – –
321	– – – –	– – – –	– – – –	6.14 ± 0.39
325	– – – –	– – – –	– – – –	4.31 ± 0.31

329	− − −−	− − −−	− − −−	3.24 ± 0.28
333	− − −−	− − −−	− − −−	3.95 ± 0.26
337	− − −−	− − −−	− − −−	3.07 ± 0.22
341	− − −−	− − −−	− − −−	2.68 ± 0.22
354	− − −−	− − −−	− − −−	2.28 ± 0.18
362	− − −−	− − −−	− − −−	2.32 ± 0.17
376	− − −−	− − −−	− − −−	1.98 ± 0.15
391	− − −−	− − −−	− − −−	2.30 ± 0.25
406	− − −−	− − −−	− − −−	1.98 ± 0.21
420	− − −−	− − −−	− − −−	1.75 ± 0.20
432	− − −−	− − −−	− − −−	2.01 ± 0.12
452	− − −−	− − −−	− − −−	1.60 ± 0.26
469	− − −−	− − −−	− − −−	2.03 ± 0.20
–	− − −−	− − −−	− − −−	− − −−
–	− − −−	− − −−	− − −−	− − −−
610	1.06 ± 0.064	1.28 ± 0.12	1.14 ± 0.1	3.63 ± 0.22
612	1.15 ± 0.080	1.30 ± 0.12	1.21 ± 0.09	3.56 ± 0.27
615	1.19 ± 0.076	1.16 ± 0.090	1.18 ± 0.05	4.77 ± 0.38
617	1.18 ± 0.089	1.17 ± 0.25	1.18 ± 0.07	3.33 ± 0.26
619	1.16 ± 0.085	1.25 ± 0.11	1.20 ± 0.07	4.64 ± 0.40
622	1.35 ± 0.080	1.37 ± 0.11	1.36 ± 0.05	4.74 ± 0.60
625	1.27 ± 0.097	1.34 ± 0.11	1.30 ± 0.06	4.85 ± 0.33
628	1.28 ± 0.076	1.20 ± 0.090	1.24 ± 0.06	5.19 ± 0.48
631	1.29 ± 0.093	1.44 ± 0.11	1.36 ± 0.09	5.02 ± 0.29
633	1.36 ± 0.089	1.30 ± 0.090	1.33 ± 0.06	5.36 ± 0.34
636	1.52 ± 0.12	1.32 ± 0.12	1.42 ± 0.1	6.28 ± 0.49
639	1.46 ± 0.13	1.45 ± 0.15	1.45 ± 0.07	5.84 ± 0.39
642	1.37 ± 0.097	1.37 ± 0.10	1.37 ± 0.05	5.91 ± 0.39
645	1.12 ± 0.11	1.61 ± 0.12	1.35 ± 0.3	6.16 ± 0.36
648	1.48 ± 0.13	1.35 ± 0.097	1.41 ± 0.09	6.07 ± 0.35
651	1.14 ± 0.10	1.51 ± 0.13	1.30 ± 0.2	6.60 ± 0.43
654	1.34 ± 0.11	1.47 ± 0.16	1.39 ± 0.10	6.49 ± 0.40
656	1.47 ± 0.15	1.49 ± 0.16	1.48 ± 0.08	6.62 ± 0.47
659	1.47 ± 0.14	1.39 ± 0.11	1.42 ± 0.08	7.12 ± 0.49
661	1.46 ± 0.11	1.53 ± 0.10	1.49 ± 0.07	7.15 ± 0.40
664	1.33 ± 0.080	1.48 ± 0.14	1.39 ± 0.10	7.33 ± 0.43
667	1.36 ± 0.11	1.31 ± 0.10	1.34 ± 0.06	7.52 ± 0.43
671	1.26 ± 0.11	1.55 ± 0.13	1.39 ± 0.2	7.47 ± 0.44
673	1.28 ± 0.089	1.29 ± 0.090	1.29 ± 0.05	7.50 ± 0.47
–	− − −−	− − −−	− − −−	− − −−
678	− − −−	− − −−	− − −−	6.72 ± 0.46
680	− − −−	− − −−	− − −−	6.08 ± 0.47
683	− − −−	− − −−	− − −−	4.96 ± 0.34
685	− − −−	− − −−	− − −−	4.93 ± 0.38
687	− − −−	− − −−	− − −−	4.12 ± 0.24
689	− − −−	− − −−	− − −−	4.20 ± 0.37
693	− − −−	− − −−	− − −−	3.61 ± 0.20
695	− − −−	− − −−	− − −−	3.21 ± 0.29
698	− − −−	− − −−	− − −−	3.03 ± 0.18
700	− − −−	− − −−	− − −−	3.06 ± 0.20
702	− − −−	− − −−	− − −−	3.72 ± 0.33

705	– – – –	– – – –	– – – –	3.86 ± 0.29
708	– – – –	– – – –	– – – –	2.83 ± 0.22
712	– – – –	– – – –	– – – –	2.81 ± 0.21
716	– – – –	– – – –	– – – –	3.01 ± 0.18
722	– – – –	– – – –	– – – –	2.39 ± 0.20
728	– – – –	– – – –	– – – –	1.94 ± 0.12
735	– – – –	– – – –	– – – –	1.77 ± 0.15
743	– – – –	– – – –	– – – –	2.20 ± 0.18
751	– – – –	– – – –	– – – –	1.95 ± 0.17
760	– – – –	– – – –	– – – –	1.50 ± 0.15
771	– – – –	– – – –	– – – –	1.72 ± 0.18
781	– – – –	– – – –	– – – –	1.31 ± 0.099
794	– – – –	– – – –	– – – –	1.51 ± 0.14
812	– – – –	– – – –	– – – –	1.45 ± 0.17
823	– – – –	– – – –	– – – –	1.26 ± 0.11
830	– – – –	– – – –	– – – –	1.51 ± 0.12
838	– – – –	– – – –	– – – –	1.25 ± 0.16
849	– – – –	– – – –	– – – –	1.22 ± 0.11

Table 2: Species densities measured in spectral window b

time min	NH_3 1387.916 ($10^{14}cm^3$)	NH_3 1388.055 ($10^{14}cm^3$)	NH_3 averaged ($10^{14}cm^3$)	HCN 1388.181 ($10^{14}cm^3$)	H_2O 1387.933 ($10^{14}cm^3$)	H_2O 1388.348 ($10^{14}cm^3$)	H_2O averaged ($10^{14}cm^3$)
2	23.9 ± 1.6	21.4 ± 1.3	22.6 ± 1.5	4.31 ± 0.36	20.7 ± 1.5	21.1 ± 1.2	20.9 ± 1.8
8	23.4 ± 1.9	22.0 ± 1.7	22.7 ± 1.2	4.62 ± 0.44	20.4 ± 1.6	20.7 ± 1.6	20.5 ± 1.8
13	20.4 ± 1.6	23.3 ± 1.6	21.8 ± 1.7	4.47 ± 0.31	20.7 ± 1.5	21.5 ± 1.3	21.0 ± 1.9
17	20.7 ± 1.6	24.5 ± 1.7	22.5 ± 2.1	4.57 ± 0.31	20.1 ± 1.5	21.6 ± 1.3	20.7 ± 2.0
22	23.2 ± 1.7	21.4 ± 1.2	22.1 ± 1.2	5.13 ± 0.42	19.2 ± 1.4	18.6 ± 1.1	18.9 ± 1.7
27	21.8 ± 1.6	21.9 ± 1.3	21.9 ± 0.80	5.03 ± 0.34	20.8 ± 1.5	20.6 ± 1.2	20.7 ± 1.8
32	20.4 ± 1.4	20.4 ± 1.3	20.4 ± 0.73	5.64 ± 0.47	19.8 ± 1.5	18.5 ± 1.5	19.3 ± 1.8
38	19.8 ± 1.3	19.7 ± 1.3	19.8 ± 0.71	5.87 ± 0.47	19.0 ± 1.3	18.5 ± 1.1	18.8 ± 1.7
43	21.9 ± 1.6	20.1 ± 1.3	20.9 ± 1.2	6.00 ± 0.49	19.3 ± 1.4	19.5 ± 1.2	19.4 ± 1.7
48	21.1 ± 1.6	19.6 ± 1.4	20.3 ± 1.1	6.23 ± 0.52	18.4 ± 1.3	18.1 ± 1.0	18.3 ± 1.6
–	– – ––	– – ––	– – ––	– – ––	– – ––	– – ––	– – ––
59	25.3 ± 1.7	26.1 ± 1.6	25.7 ± 0.96	2.95 ± 0.19	23.9 ± 1.7	24.7 ± 1.4	24.2 ± 2.2
63	25.8 ± 1.7	25.3 ± 1.6	25.5 ± 0.93	2.73 ± 0.17	25.0 ± 1.7	26.1 ± 1.8	25.4 ± 2.3
68	25.4 ± 1.7	23.9 ± 1.5	24.6 ± 1.1	2.61 ± 0.21	26.8 ± 2.0	25.1 ± 1.5	26.1 ± 2.5
74	23.3 ± 1.6	25.7 ± 1.6	24.5 ± 1.5	2.22 ± 0.14	25.6 ± 1.8	26.5 ± 1.6	26.0 ± 2.3
80	26.0 ± 1.8	27.0 ± 1.7	26.5 ± 1.0	1.99 ± 0.17	22.5 ± 1.6	21.5 ± 1.4	22.1 ± 2.0
87	27.4 ± 2.1	28.0 ± 1.8	27.7 ± 1.1	1.68 ± 0.099	21.1 ± 1.6	22.3 ± 1.5	21.6 ± 2.0
91	26.5 ± 1.8	26.1 ± 1.5	26.3 ± 0.91	1.74 ± 0.11	26.1 ± 1.9	25.8 ± 1.6	26.0 ± 2.3
99	25.9 ± 1.7	25.3 ± 1.6	25.6 ± 0.94	1.62 ± 0.11	27.8 ± 2.0	27.7 ± 1.6	27.8 ± 2.4
110	25.3 ± 1.7	25.8 ± 1.6	25.6 ± 0.93	1.43 ± 0.086	27.9 ± 2.1	28.8 ± 1.8	28.3 ± 2.5
119	26.3 ± 1.7	25.9 ± 1.5	26.1 ± 0.90	1.34 ± 0.078	28.9 ± 2.1	27.4 ± 1.5	28.2 ± 2.6
131	25.6 ± 1.7	26.3 ± 1.6	26.0 ± 0.97	1.19 ± 0.073	29.8 ± 2.2	30.2 ± 1.8	30.0 ± 2.7
143	27.2 ± 1.8	24.9 ± 1.4	26.0 ± 1.4	1.16 ± 0.070	30.6 ± 2.3	29.2 ± 1.6	30.0 ± 2.7
153	26.5 ± 1.7	26.4 ± 1.6	26.4 ± 0.90	1.03 ± 0.060	29.4 ± 2.1	32.3 ± 2.1	30.5 ± 3.0
166	26.4 ± 1.9	27.0 ± 1.6	26.8 ± 1.0	1.06 ± 0.078	30.4 ± 2.3	30.7 ± 2.0	30.6 ± 2.7
201	27.1 ± 1.9	26.3 ± 1.6	26.7 ± 1.0	0.828 ± 0.065	30.4 ± 2.2	33.5 ± 2.1	31.6 ± 3.2
242	27.4 ± 1.8	27.3 ± 1.6	27.3 ± 0.92	0.667 ± 0.068	30.8 ± 2.2	30.2 ± 1.8	30.5 ± 2.7
–	– – ––	– – ––	– – ––	– – ––	– – ––	– – ––	– – ––
262	28.9 ± 1.9	28.2 ± 1.6	28.5 ± 1.0	1.63 ± 0.11	19.0 ± 1.5	17.1 ± 0.95	18.2 ± 1.9
268	27.6 ± 2.1	26.8 ± 1.6	27.2 ± 1.1	2.38 ± 0.19	19.8 ± 1.5	17.9 ± 1.6	19.0 ± 2.0
272	25.3 ± 1.8	25.8 ± 1.6	25.6 ± 0.93	2.72 ± 0.17	19.8 ± 1.5	19.0 ± 1.1	19.5 ± 1.8
277	25.5 ± 1.7	26.0 ± 1.6	25.8 ± 0.93	3.08 ± 0.18	18.4 ± 1.3	17.3 ± 1.1	18.0 ± 1.7
282	25.2 ± 1.7	24.2 ± 1.5	24.7 ± 1.0	3.55 ± 0.23	18.8 ± 1.4	20.0 ± 1.3	19.3 ± 1.8
287	24.4 ± 1.7	26.0 ± 1.6	25.2 ± 1.2	3.63 ± 0.21	17.7 ± 1.3	19.1 ± 1.2	18.3 ± 1.7
291	24.6 ± 1.7	25.6 ± 1.5	25.1 ± 1.0	4.07 ± 0.25	17.7 ± 1.3	18.6 ± 1.1	18.1 ± 1.7
296	25.8 ± 1.8	24.3 ± 1.4	25.0 ± 1.1	4.70 ± 0.34	18.6 ± 1.4	16.2 ± 0.92	17.6 ± 2.0
301	23.8 ± 1.7	23.8 ± 1.4	23.8 ± 0.81	4.92 ± 0.34	18.4 ± 1.4	18.1 ± 1.1	18.3 ± 1.6
305	24.3 ± 1.7	24.4 ± 1.4	24.3 ± 0.83	5.09 ± 0.31	16.6 ± 1.2	16.3 ± 1.00	16.4 ± 1.5
310	22.8 ± 1.7	24.4 ± 1.4	23.6 ± 1.2	5.27 ± 0.34	17.4 ± 1.2	18.3 ± 1.0	17.8 ± 1.6
315	23.0 ± 1.6	23.6 ± 1.3	23.3 ± 0.85	5.62 ± 0.36	17.5 ± 1.3	18.0 ± 1.00	17.7 ± 1.6
–	– – ––	– – ––	– – ––	– – ––	– – ––	– – ––	– – ––
322	24.6 ± 1.8	25.0 ± 1.5	24.8 ± 0.90	4.54 ± 0.29	18.7 ± 1.4	19.1 ± 1.3	18.8 ± 1.7
326	28.2 ± 1.9	26.2 ± 1.6	27.1 ± 1.4	3.44 ± 0.24	18.6 ± 1.5	17.6 ± 1.1	18.2 ± 1.7
330	27.0 ± 1.9	27.8 ± 1.8	27.4 ± 1.1	2.65 ± 0.15	16.4 ± 1.2	17.9 ± 1.1	17.0 ± 1.7
334	27.4 ± 1.9	29.4 ± 1.7	28.5 ± 1.4	2.37 ± 0.13	16.1 ± 1.2	16.5 ± 1.0	16.2 ± 1.5
338	27.4 ± 1.9	29.0 ± 1.7	28.2 ± 1.2	2.23 ± 0.12	16.0 ± 1.1	17.3 ± 1.1	16.5 ± 1.6

342	29.0 ± 2.3	29.4 ± 1.7	29.3 ± 1.1	2.14 ± 0.13	16.3 ± 1.3	15.0 ± 1.2	15.7 ± 1.6
355	30.4 ± 2.3	29.6 ± 1.7	30.0 ± 1.1	1.84 ± 0.12	16.7 ± 1.3	17.4 ± 1.2	17.0 ± 1.6
363	29.8 ± 2.1	29.8 ± 1.8	29.8 ± 1.0	1.55 ± 0.10	15.9 ± 1.2	14.6 ± 1.1	15.4 ± 1.5
377	30.5 ± 1.9	29.0 ± 1.7	29.7 ± 1.2	1.50 ± 0.11	16.4 ± 1.2	14.8 ± 0.92	15.7 ± 1.6
392	31.1 ± 2.3	30.2 ± 1.8	30.6 ± 1.2	1.37 ± 0.091	16.5 ± 1.3	14.6 ± 0.95	15.7 ± 1.7
407	30.6 ± 2.3	31.2 ± 1.9	30.9 ± 1.2	1.05 ± 0.060	15.2 ± 1.1	13.4 ± 0.79	14.4 ± 1.6
421	31.5 ± 2.3	30.1 ± 1.8	30.7 ± 1.3	1.00 ± 0.065	15.4 ± 1.1	13.0 ± 0.74	14.3 ± 1.7
433	31.7 ± 2.3	30.0 ± 1.8	30.8 ± 1.4	0.978 ± 0.099	15.0 ± 1.1	14.5 ± 0.93	14.8 ± 1.3
453	30.6 ± 2.1	31.8 ± 1.9	31.2 ± 1.3	0.884 ± 0.055	15.2 ± 1.1	12.8 ± 0.77	14.1 ± 1.7
470	32.0 ± 2.3	30.2 ± 1.8	31.0 ± 1.4	0.821 ± 0.062	15.3 ± 1.1	12.7 ± 0.80	14.1 ± 1.8
–	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –
–	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –
610	25.2 ± 1.8	24.1 ± 1.5	24.6 ± 1.0	2.95 ± 0.19	13.0 ± 0.87	13.7 ± 1.1	13.3 ± 1.2
613	24.9 ± 1.7	23.9 ± 1.4	24.4 ± 0.97	3.27 ± 0.24	13.0 ± 0.86	11.1 ± 0.79	12.2 ± 1.4
615	23.2 ± 1.6	23.4 ± 1.4	23.3 ± 0.81	3.46 ± 0.26	13.2 ± 0.89	13.6 ± 0.85	13.4 ± 1.2
618	23.3 ± 1.6	23.1 ± 1.4	23.2 ± 0.80	3.73 ± 0.29	13.1 ± 0.85	12.9 ± 0.75	13.0 ± 1.1
620	25.7 ± 1.7	22.8 ± 1.4	24.1 ± 1.7	3.76 ± 0.25	12.7 ± 0.80	12.7 ± 0.69	12.7 ± 1.1
623	23.1 ± 1.6	24.7 ± 1.5	23.9 ± 1.1	3.82 ± 0.23	12.6 ± 0.79	12.7 ± 0.80	12.6 ± 1.1
626	23.0 ± 1.5	22.9 ± 1.3	23.0 ± 0.78	4.18 ± 0.29	13.0 ± 0.84	12.1 ± 0.70	12.6 ± 1.2
629	25.2 ± 1.8	22.5 ± 1.4	23.7 ± 1.6	4.48 ± 0.31	12.9 ± 0.89	12.8 ± 0.75	12.9 ± 1.1
631	27.0 ± 1.9	22.2 ± 1.3	24.1 ± 2.5	4.67 ± 0.34	12.2 ± 0.81	12.8 ± 0.72	12.4 ± 1.1
634	23.1 ± 1.5	26.0 ± 1.7	24.5 ± 1.7	4.59 ± 0.29	11.8 ± 0.75	11.4 ± 0.67	11.6 ± 1.0
637	24.7 ± 1.6	22.5 ± 1.3	23.5 ± 1.4	5.17 ± 0.39	13.0 ± 0.84	12.4 ± 0.70	12.8 ± 1.2
640	24.1 ± 1.6	25.1 ± 1.5	24.6 ± 0.98	5.14 ± 0.31	12.1 ± 0.79	11.3 ± 0.69	11.7 ± 1.1
643	23.8 ± 1.6	23.8 ± 1.6	23.8 ± 0.86	5.52 ± 0.39	12.7 ± 0.86	12.7 ± 0.82	12.7 ± 1.1
646	23.5 ± 1.6	21.9 ± 1.3	22.6 ± 1.1	5.83 ± 0.42	12.4 ± 0.84	13.1 ± 0.75	12.7 ± 1.2
649	23.6 ± 1.8	21.5 ± 1.3	22.4 ± 1.3	6.16 ± 0.47	12.3 ± 0.89	13.3 ± 0.72	12.7 ± 1.2
652	23.9 ± 1.7	23.3 ± 1.4	23.6 ± 0.86	6.01 ± 0.42	12.2 ± 0.83	12.2 ± 0.82	12.2 ± 1.1
654	22.7 ± 1.6	21.9 ± 1.3	22.3 ± 0.87	6.34 ± 0.47	11.8 ± 0.87	12.7 ± 0.75	12.1 ± 1.2
657	21.9 ± 1.6	21.7 ± 1.3	21.8 ± 0.76	6.30 ± 0.44	11.2 ± 0.77	11.7 ± 0.85	11.4 ± 1.0
660	22.5 ± 1.6	21.8 ± 1.3	22.1 ± 0.83	6.57 ± 0.49	11.7 ± 0.80	12.6 ± 0.77	12.1 ± 1.1
662	22.4 ± 1.6	22.0 ± 1.3	22.2 ± 0.81	6.75 ± 0.49	11.8 ± 0.81	12.7 ± 0.79	12.1 ± 1.1
665	21.8 ± 1.6	23.1 ± 1.4	22.5 ± 1.0	6.74 ± 0.49	11.2 ± 0.79	11.5 ± 0.72	11.3 ± 1.0
668	22.0 ± 1.7	23.4 ± 1.4	22.8 ± 1.1	6.89 ± 0.49	11.9 ± 0.83	11.6 ± 0.75	11.8 ± 1.1
671	22.0 ± 1.7	22.9 ± 1.3	22.5 ± 0.91	7.12 ± 0.55	11.7 ± 0.81	10.9 ± 0.64	11.4 ± 1.1
674	23.2 ± 1.7	23.5 ± 1.4	23.4 ± 0.85	7.29 ± 0.55	11.5 ± 0.78	10.2 ± 0.62	10.9 ± 1.1
–	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –
679	24.8 ± 1.8	23.8 ± 1.5	24.2 ± 1.0	5.74 ± 0.44	12.2 ± 0.77	12.0 ± 0.72	12.1 ± 1.1
681	27.3 ± 1.9	24.5 ± 1.5	25.7 ± 1.7	4.82 ± 0.34	11.9 ± 0.80	11.9 ± 0.69	11.9 ± 1.0
683	27.6 ± 2.1	26.2 ± 1.6	26.8 ± 1.2	4.25 ± 0.31	11.1 ± 0.78	9.46 ± 0.69	10.4 ± 1.2
686	28.0 ± 2.1	26.3 ± 1.6	27.1 ± 1.3	3.87 ± 0.29	10.6 ± 0.77	9.98 ± 0.56	10.3 ± 0.96
688	28.4 ± 2.1	26.2 ± 1.6	27.2 ± 1.5	3.60 ± 0.25	10.0 ± 0.76	10.4 ± 0.70	10.2 ± 0.93
690	28.1 ± 2.1	26.2 ± 1.6	27.0 ± 1.3	3.51 ± 0.26	10.0 ± 0.73	8.48 ± 0.59	9.34 ± 1.1
694	28.6 ± 2.1	28.0 ± 1.7	28.3 ± 1.1	3.08 ± 0.20	9.21 ± 0.73	9.76 ± 0.72	9.43 ± 0.89
696	28.8 ± 2.1	27.6 ± 1.7	28.1 ± 1.2	3.02 ± 0.20	10.1 ± 0.70	9.03 ± 0.51	9.62 ± 1.00
698	29.5 ± 2.1	27.6 ± 1.7	28.5 ± 1.4	2.81 ± 0.19	9.34 ± 0.77	9.60 ± 0.69	9.45 ± 0.87
701	28.0 ± 1.9	28.2 ± 1.7	28.1 ± 1.0	2.68 ± 0.17	9.07 ± 0.66	9.24 ± 0.64	9.14 ± 0.82
703	28.4 ± 1.9	27.6 ± 1.7	28.0 ± 1.1	2.61 ± 0.17	8.74 ± 0.65	8.90 ± 0.51	8.80 ± 0.78
706	28.7 ± 2.1	28.4 ± 1.7	28.5 ± 1.0	2.50 ± 0.16	9.12 ± 0.60	6.81 ± 0.43	8.02 ± 1.3
708	28.7 ± 2.1	28.4 ± 1.8	28.5 ± 1.1	2.41 ± 0.16	9.36 ± 0.68	8.55 ± 0.46	9.01 ± 0.89
712	28.3 ± 1.9	28.4 ± 1.7	28.4 ± 0.99	2.36 ± 0.16	9.03 ± 0.65	7.19 ± 0.43	8.18 ± 1.2

716	28.4 ± 2.1	28.7 ± 1.8	28.6 ± 1.0	2.22 ± 0.15	8.82 ± 0.67	8.84 ± 0.62	8.82 ± 0.79
723	28.1 ± 2.1	29.4 ± 1.9	28.8 ± 1.3	2.09 ± 0.14	8.71 ± 0.61	7.69 ± 0.48	8.26 ± 0.89
729	29.0 ± 2.1	27.9 ± 1.8	28.4 ± 1.2	2.02 ± 0.14	8.71 ± 0.62	8.48 ± 0.62	8.62 ± 0.77
736	29.3 ± 2.1	28.2 ± 1.7	28.7 ± 1.2	1.95 ± 0.15	8.25 ± 0.58	6.39 ± 0.49	7.39 ± 1.1
744	29.2 ± 2.1	29.1 ± 1.8	29.2 ± 1.0	1.81 ± 0.14	8.92 ± 0.63	6.54 ± 0.49	7.78 ± 1.4
752	28.6 ± 2.1	28.5 ± 1.8	28.5 ± 1.0	1.65 ± 0.12	8.19 ± 0.56	6.86 ± 0.67	7.61 ± 0.95
761	29.5 ± 2.3	27.8 ± 1.7	28.6 ± 1.4	1.61 ± 0.11	8.15 ± 0.69	8.13 ± 0.74	8.14 ± 0.75
772	28.4 ± 2.1	27.5 ± 1.7	27.9 ± 1.1	1.42 ± 0.13	7.72 ± 0.62	7.78 ± 0.67	7.74 ± 0.71
782	29.8 ± 2.1	27.6 ± 1.6	28.5 ± 1.5	1.39 ± 0.099	8.06 ± 0.65	6.26 ± 0.51	7.21 ± 1.1
796	28.3 ± 2.1	27.7 ± 1.6	28.0 ± 1.1	1.25 ± 0.080	6.64 ± 0.68	7.93 ± 0.57	7.14 ± 0.93
812	28.5 ± 2.3	28.3 ± 1.8	28.4 ± 1.1	1.08 ± 0.068	7.62 ± 0.58	4.97 ± 0.34	6.26 ± 1.4
824	30.5 ± 2.3	28.7 ± 1.7	29.5 ± 1.4	1.12 ± 0.093	7.56 ± 0.55	4.34 ± 0.62	5.92 ± 1.7
832	29.1 ± 2.3	28.0 ± 1.7	28.5 ± 1.2	1.04 ± 0.068	6.94 ± 0.68	4.94 ± 0.38	5.92 ± 1.1
839	29.2 ± 2.3	27.8 ± 1.6	28.4 ± 1.3	1.05 ± 0.065	7.73 ± 0.54	4.63 ± 0.36	6.09 ± 1.6
849	27.9 ± 2.1	28.1 ± 1.7	28.0 ± 1.0	0.944 ± 0.062	6.79 ± 0.60	5.74 ± 0.43	6.31 ± 0.78

Table 3: Species densities measured in spectral window c

time min	^{13}CO 2106.897 (10^{14}cm^3)	CO 2107.423 (10^{14}cm^3)	CO averaged (10^{14}cm^3)
3	6.64 ± 0.88	6.98 ± 1.2	6.81 ± 0.63
9	5.74 ± 0.65	7.11 ± 1.3	6.31 ± 0.88
14	7.54 ± 0.54	6.92 ± 1.3	7.27 ± 0.67
18	6.39 ± 0.38	7.49 ± 1.5	6.78 ± 0.78
23	7.22 ± 0.42	7.50 ± 1.6	7.32 ± 0.63
28	8.64 ± 0.54	7.46 ± 1.7	8.16 ± 0.91
33	7.94 ± 0.50	7.47 ± 1.7	7.76 ± 0.71
39	8.22 ± 0.50	7.79 ± 1.9	8.07 ± 0.74
44	8.29 ± 0.46	7.99 ± 1.8	8.18 ± 0.71
49	7.96 ± 0.42	8.06 ± 1.9	8.00 ± 0.69
−−	− − −−	− − −−	− − −−
60	7.89 ± 0.50	7.12 ± 1.5	7.57 ± 0.74
64	6.73 ± 0.37	6.40 ± 1.4	6.60 ± 0.57
70	6.55 ± 0.36	6.59 ± 1.4	6.57 ± 0.54
76	6.02 ± 0.34	6.49 ± 1.3	6.19 ± 0.56
82	4.34 ± 0.24	6.49 ± 1.3	4.98 ± 1.1
88	4.95 ± 0.29	5.46 ± 0.99	5.15 ± 0.48
93	5.57 ± 0.33	6.02 ± 1.1	5.75 ± 0.50
101	4.81 ± 0.30	5.60 ± 1.0	5.11 ± 0.57
115	4.30 ± 0.28	5.01 ± 0.88	4.58 ± 0.51
122	3.96 ± 0.26	5.04 ± 0.83	4.38 ± 0.63
133	3.89 ± 0.22	4.86 ± 0.81	4.26 ± 0.58
145	3.65 ± 0.26	4.62 ± 0.75	4.03 ± 0.58
161	3.36 ± 0.22	4.11 ± 0.62	3.67 ± 0.46
169	3.26 ± 0.20	4.19 ± 0.65	3.63 ± 0.54
204	3.31 ± 0.25	4.18 ± 0.55	3.70 ± 0.51
244	2.95 ± 0.18	3.85 ± 0.44	3.36 ± 0.50
−−	− − −−	− − −−	− − −−
266	2.48 ± 0.15	4.01 ± 0.49	3.07 ± 0.79
270	4.47 ± 0.28	4.75 ± 0.68	4.60 ± 0.36
276	4.43 ± 0.27	5.03 ± 0.83	4.67 ± 0.47
280	4.92 ± 0.30	5.39 ± 0.96	5.11 ± 0.46
285	4.97 ± 0.34	5.56 ± 0.96	5.21 ± 0.50
290	5.50 ± 0.33	5.79 ± 1.1	5.62 ± 0.47
294	5.53 ± 0.35	5.95 ± 1.1	5.69 ± 0.50
300	6.21 ± 0.36	6.65 ± 1.2	6.38 ± 0.55
304	6.18 ± 0.34	6.61 ± 1.2	6.35 ± 0.54
309	6.05 ± 0.54	6.96 ± 1.3	6.41 ± 0.71
313	6.54 ± 0.38	7.26 ± 1.5	6.81 ± 0.66
318	6.93 ± 0.42	7.24 ± 1.5	7.05 ± 0.60
−−	− − −−	− − −−	− − −−
324	6.37 ± 0.36	6.73 ± 1.2	6.52 ± 0.54
327	5.04 ± 0.35	5.75 ± 1.0	5.32 ± 0.55
331	4.61 ± 0.27	5.40 ± 0.86	4.93 ± 0.54
335	4.29 ± 0.24	5.40 ± 1.1	4.67 ± 0.67
339	3.85 ± 0.25	5.01 ± 0.94	4.26 ± 0.67

344	3.75 ± 0.28	4.82 ± 0.78	4.17 ± 0.63
357	3.17 ± 0.21	4.33 ± 0.68	3.61 ± 0.64
365	2.94 ± 0.17	4.11 ± 0.60	3.39 ± 0.63
378	2.97 ± 0.20	3.67 ± 0.47	3.28 ± 0.42
394	2.33 ± 0.25	3.32 ± 0.42	2.78 ± 0.53
409	2.27 ± 0.17	3.13 ± 0.39	2.64 ± 0.47
422	2.12 ± 0.13	2.97 ± 0.34	2.49 ± 0.46
436	1.95 ± 0.13	2.84 ± 0.34	2.33 ± 0.47
455	1.79 ± 0.17	2.65 ± 0.31	2.17 ± 0.46
472	1.93 ± 0.26	2.54 ± 0.29	2.25 ± 0.35
−−	− − − −−	− − − −−	− − − −−
−−	− − − −−	− − − −−	− − − −−
611	3.42 ± 0.20	4.02 ± 0.60	3.67 ± 0.40
613	3.48 ± 0.19	4.14 ± 0.62	3.75 ± 0.43
616	3.23 ± 0.21	4.27 ± 0.65	3.63 ± 0.59
618	3.84 ± 0.20	4.35 ± 0.65	4.06 ± 0.39
621	3.79 ± 0.22	4.49 ± 0.70	4.08 ± 0.46
624	3.95 ± 0.22	4.58 ± 0.73	4.21 ± 0.44
627	4.13 ± 0.30	4.63 ± 0.73	4.34 ± 0.42
630	4.23 ± 0.22	4.86 ± 0.81	4.48 ± 0.46
632	4.38 ± 0.28	4.92 ± 0.83	4.60 ± 0.45
635	4.72 ± 0.26	4.99 ± 0.83	4.83 ± 0.39
638	4.44 ± 0.24	5.12 ± 0.83	4.72 ± 0.49
641	4.82 ± 0.27	5.21 ± 0.91	4.98 ± 0.43
643	4.89 ± 0.29	5.21 ± 0.94	5.02 ± 0.42
647	5.10 ± 0.30	5.43 ± 0.96	5.24 ± 0.44
650	4.81 ± 0.30	5.44 ± 0.96	5.06 ± 0.50
653	4.95 ± 0.31	5.42 ± 0.99	5.14 ± 0.47
655	4.94 ± 0.27	5.44 ± 1.0	5.13 ± 0.48
658	5.10 ± 0.27	5.50 ± 1.0	5.26 ± 0.46
660	5.36 ± 0.28	5.60 ± 1.0	5.46 ± 0.44
662	5.64 ± 0.30	5.58 ± 1.1	5.61 ± 0.45
665	5.87 ± 0.34	5.66 ± 1.1	5.78 ± 0.47
668	5.28 ± 0.30	5.85 ± 1.1	5.49 ± 0.52
672	5.55 ± 0.30	5.68 ± 1.1	5.60 ± 0.45
674	5.28 ± 0.30	5.71 ± 1.1	5.45 ± 0.48
−−	− − − −−	− − − −−	− − − −−
680	5.32 ± 0.30	5.54 ± 1.0	5.41 ± 0.44
682	4.48 ± 0.28	4.88 ± 0.86	4.64 ± 0.41
684	3.98 ± 0.24	4.42 ± 0.70	4.17 ± 0.38
686	3.34 ± 0.19	4.17 ± 0.65	3.67 ± 0.50
688	3.28 ± 0.18	3.98 ± 0.60	3.57 ± 0.44
−−	− − − −−	− − − −−	− − − −−
694	2.89 ± 0.18	3.58 ± 0.49	3.19 ± 0.41
697	2.95 ± 0.18	3.42 ± 0.47	3.16 ± 0.32
699	2.62 ± 0.17	3.29 ± 0.42	2.92 ± 0.39
701	2.67 ± 0.17	3.13 ± 0.39	2.88 ± 0.30
704	2.39 ± 0.17	3.09 ± 0.39	2.70 ± 0.39
707	2.45 ± 0.13	3.02 ± 0.36	2.71 ± 0.34
709	2.25 ± 0.14	2.92 ± 0.36	2.55 ± 0.38
713	2.19 ± 0.12	2.78 ± 0.31	2.46 ± 0.33

717	1.97 ± 0.18	2.67 ± 0.29	2.31 ± 0.38
724	2.03 ± 0.17	2.57 ± 0.29	2.29 ± 0.31
729	1.52 ± 0.12	2.48 ± 0.26	1.93 ± 0.50
737	1.85 ± 0.21	2.30 ± 0.24	2.09 ± 0.26
745	1.54 ± 0.14	2.15 ± 0.22	1.84 ± 0.32
753	1.26 ± 0.15	2.03 ± 0.20	1.63 ± 0.40
762	1.01 ± 0.24	1.96 ± 0.19	1.53 ± 0.49
773	1.37 ± 0.18	1.81 ± 0.17	1.62 ± 0.25
783	1.08 ± 0.16	1.70 ± 0.16	1.41 ± 0.32
796	1.15 ± 0.20	1.58 ± 0.14	1.40 ± 0.24
813	1.20 ± 0.15	1.45 ± 0.13	1.34 ± 0.15
825	1.24 ± 0.11	1.41 ± 0.12	1.34 ± 0.12
832	0.992 ± 0.13	1.35 ± 0.12	1.19 ± 0.20
840	0.337 ± 0.84	1.30 ± 0.11	1.17 ± 0.50
850	0.696 ± 0.15	1.24 ± 0.11	1.01 ± 0.28