

Supplemental material on web

TABLE 1. Assignment of the emission lines in CO LIDB plasma

Wavelength [nm]	Intensity [arb.u.]	Line identification
357.5	24779	C ₂ , Deslandes-d'Azambuja, C ¹ Π _g -A ¹ Π _u , v'=3, v''=2
358.1	45288	C ₂ , Deslandes-d'Azambuja, C ¹ Π _g -A ¹ Π _u , v'=2, v''=1
359.1	58679	C ₂ , Deslandes-d'Azambuja, C ¹ Π _g -A ¹ Π _u , v'=1, v''=0
361.4	25292	Unidentified
362.3	30729	Unidentified
364.1	28681	Unidentified
365.7	24788	Unidentified
375.1	56201	C ₃ , Swings bands, A ¹ Π _u -X ¹ Σ _g
375.4	28274	C ₃ , Swings bands, A ¹ Π _u -X ¹ Σ _g
379.8	8767	C ₃ , Swings bands, A ¹ Π _u -X ¹ Σ _g
380.2	10570	C ₃ , Swings bands, A ¹ Π _u -X ¹ Σ _g
382.0	24558	C ₂ , Deslandes-d'Azambuja, C ¹ Π _g -A ¹ Π _u , v'=1, v''=1
382.4	39009	C ₃ , Swings bands, A ¹ Π _u -X ¹ Σ _g
385.4	15689	C ₂ , Deslandes-d'Azambuja, C ¹ Π _g -A ¹ Π _u , v'=0, v''=0
386.3	13531	C ₃ , Swings bands, A ¹ Π _u -X ¹ Σ _g
388.6	17994	C ₃ , Swings bands, A ¹ Π _u -X ¹ Σ _g
390.5	7805	C ₃ , Swings bands, A ¹ Π _u -X ¹ Σ _g
393.1	9688	C ₃ , Swings bands, A ¹ Π _u -X ¹ Σ _g
400.7	5738	C ₃ , Swings bands, A ¹ Π _u -X ¹ Σ _g
404.7	35064	C ₃ , Swings bands, A ¹ Π _u -X ¹ Σ _g + C ₂ , Deslandes-d'Azambuja, C ¹ Π _g -A ¹ Π _u , v'=2, v''=3
406.5	23444	C ₃ , Swings bands, A ¹ Π _u -X ¹ Σ _g + C ₂ , Deslandes-d'Azambuja, C ¹ Π _g -A ¹ Π _u , v'=1, v''=2
407.3	20043	C ₃ , Swings bands, A ¹ Π _u -X ¹ Σ _g
436.5	15650	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=4, v''=2
437.1	11183	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=3, v''=1
438.2	29951	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=2, v''=0
468.7	78585	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=4, v''=3
469.9	79156	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=3, v''=2
471.6	79747	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=2, v''=1
473.7	71774	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=1, v''=0
477.3	12399	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=10, v''=9
483.8	8668	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=11, v''=10
491.3	13888	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=12, v''=11
505.7	19153	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=4, v''=4
507.1	47961	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=3, v''=3
509.8	60037	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=2, v''=2
513.0	95729	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=1, v''=1
516.5	153823	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=0, v''=0
543.2	12502	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=6, v''=7
550.1	14008	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=3, v''=4
554.0	11231	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=2, v''=3
558.4	22627	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=1, v''=2
563.4	20105	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=0, v''=1
589.3	7400	C ₂ , Swan bands, D ³ Π _g -A ³ Π _u , v'=6, v''=8

TABLE 2. Assignment of the emission lines in H₂O LIDB plasma

Wavelength [nm]	Intensity [arb.u.]	Line identification
388.9	3059	H _ε , Balmer series
396.7	5149	He, Balmer series
409.7	10243	H δ , Balmer series, E _{ex} =13.2eV, (² P ^o - ² D)
433.9	23907	H γ , Balmer series, E _{ex} =13.05eV, (² P ^o - ² D)
486.0	74719	H β , Balmer series, E _{ex} =12.7eV, (² P ^o - ² D)
615.7	8012	O I, ⁵ P - ⁵ D ^o , E _{ex} =12.7eV, (⁵ P - ⁵ D ^o)
656.1	354108	H α , Balmer series, E _{ex} =12.1eV, (² P ^o - ³ D)
777.1	371075	O I, ³ S ^o - ⁵ P, E _{ex} =10.7eV, (⁵ S ^o - ⁵ P)
820.4	30536	H δ , Balmer series - second order, O I, E _{ex} =14eV, (³ D ^o - ³ D)
843.9	96834	O I, ³ S ^o - ³ P, E _{ex} =10.9eV, (³ S ^o - ³ P)
867.2	82193	H γ , Balmer series – second order
971.0	378353	H β , Balmer series – second order

TABLE 3. Assignment of the emission lines in CO-N₂-H₂O mixture LIDB plasma

Wavelength [nm]	Intensity [arb.u.]	Line identification
193.0	15010	C I, ¹ D - ¹ P ^o
214.4	8495	N II, ³ P - ³ S ^o
219.6	3818	N II, ¹ P - ¹ D ^o
229.0	40290	N II, ³ P - ³ P ^o
231.7	7083	N II, ³ D - ³ F ^o
234.7	5553	N II, ¹ S - ¹ P ^o
248.3	65762	C I, ¹ S - ¹ P ^o
251.9	5317	C II, ² P - ² D ^o
283.1	23798	C II, ² S - ² P ^o
329.1	3237	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=5, v''=3
334.1	3642	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=6, v''=4
335.2	4857	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=7, v''=5
336.6	8166	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=8, v''=6
338.3	3439	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=9, v''=7
340.6	4114	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=10, v''=8
342.8	4587	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=11, v''=9
346.2	4520	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=12, v''=10
357.2	18856	C ₂ , Deslandes-d'Azambuja, C ¹ Π _g -A ¹ Π _u , v'=3, v''=2
358.3	23997	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=3, v''=2
358.2	25768	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=2, v''=1
358.5	71654	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=1, v''=0 + C ₂ , Deslandes-d'Azambuja, C ¹ Π _g -A ¹ Π _u , v'=2, v''=1
359.0	46796	C ₂ , Deslandes-d'Azambuja, C ¹ Π _g -A ¹ Π _u , v'=1, v''=0
361.4	14703	Unidentified
362.3	15393	Unidentified
363.6	18749	Unidentified
365.2	17554	Unidentified
375.1	28707	C ₃ , Swings, A ¹ Π _u -X ¹ Σ _g
375.4	37302	C ₃ , Swings, A ¹ Π _u -X ¹ Σ _g
379.2	31864	C ₃ , Swings, A ¹ Π _u -X ¹ Σ _g
380.1	44567	C ₃ , Swings, A ¹ Π _u -X ¹ Σ _g
382.2	101181	C ₂ , Deslandes-d'Azambuja, C ¹ Π _g -A ¹ Π _u , v'=1, v''=1
385.1	198473	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=4, v''=4
385.5	191420	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=3, v''=3
386.2	219740	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=2, v''=2
387.2	300780	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=1, v''=1
388.3	391577	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=0, v''=0
390.2	20815	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=11, v''=11
393.1	19047	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=12, v''=12
397.0	13036	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=13, v''=13
404.7	57506	C ₃ , Swings, A ¹ Π _u -X ¹ Σ _g + C ₂ , Deslandes-d'Azambuja, C ¹ Π _g -A ¹ Π _u , v'=2, v''=3
406.5	31468	C ₃ , Swings, A ¹ Π _u -X ¹ Σ _g + C ₂ , Deslandes-d'Azambuja, C ¹ Π _g -A ¹ Π _u , v'=1, v''=2
407.3	29583	C ₃ , Swings, A ¹ Π _u -X ¹ Σ _g
415.1	100668	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=5, v''=6
415.7	104413	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=4, v''=5
416.7	115379	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=3, v''=4
418.0	128356	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=2, v''=3
419.6	145003	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=1, v''=2
421.4	121657	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=0, v''=1
436.2	1268	C ₂ , Swan, D ³ Π _g -A ³ Π _u , v'=4, v''=2
437.0	1053	C ₂ , Swan, D ³ Π _g -A ³ Π _u , v'=3, v''=1
438.2	48202	C ₂ , Swan, D ³ Π _g -A ³ Π _u , v'=2, v''=0
450.04	1206	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=5, v''=7
451.36	2582	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=4, v''=6
453.09	4326	CN, B ² Σ ⁺ _u - X ² Σ ⁺ _g , v'=3, v''=5

455.19	3824	CN, $B^2\Sigma_u^+ - X^2\Sigma_g^+$, $v'=2, v''=4$
457.6	3454	CN, $B^2\Sigma_u^+ - X^2\Sigma_g^+$, $v'=1, v''=3$
460.4	2737	CN, $B^2\Sigma_u^+ - X^2\Sigma_g^+$, $v'=0, v''=2$
467.9	9086	C_2 , Swan, $D^3\Pi_g - A^3\Pi_u$, $v'=4, v''=3$
469.9	9016	C_2 , Swan, $D^3\Pi_g - A^3\Pi_u$, $v'=3, v''=2$
471.6	8284	C_2 , Swan, $D^3\Pi_g - A^3\Pi_u$, $v'=2, v''=1$
473.7	6516	C_2 , Swan, $D^3\Pi_g - A^3\Pi_u$, $v'=1, v''=0$
512.6	13367	C_2 , Swan, $D^3\Pi_g - A^3\Pi_u$, $v'=1, v''=1$
714.7	9540	CN, $B^2\Sigma_u^+ - X^2\Sigma_g^+$, $v'=2, v''=1$ – second order
719.1	11678	CN, $B^2\Sigma_u^+ - X^2\Sigma_g^+$, $v'=1, v''=0$ – second order
772.3	37892	CN, $B^2\Sigma_u^+ - X^2\Sigma_g^+$, $v'=3, v''=3$ – second order
774.4	39779	CN, $B^2\Sigma_u^+ - X^2\Sigma_g^+$, $v'=2, v''=2$ – second order
776.2	44874	CN, $B^2\Sigma_u^+ - X^2\Sigma_g^+$, $v'=1, v''=1$ – second order
778.6	49970	CN, $B^2\Sigma_u^+ - X^2\Sigma_g^+$, $v'=0, v''=0$ – second order
832.7	11564	CN, $B^2\Sigma_u^+ - X^2\Sigma_g^+$, $v'=4, v''=5$ – second order
834.7	11267	CN, $B^2\Sigma_u^+ - X^2\Sigma_g^+$, $v'=3, v''=4$ – second order
837.9	11192	CN, $B^2\Sigma_u^+ - X^2\Sigma_g^+$, $v'=2, v''=3$ – second order
841.1	11198	CN, $B^2\Sigma_u^+ - X^2\Sigma_g^+$, $v'=1, v''=2$ – second order
844.0	8217	CN, $B^2\Sigma_u^+ - X^2\Sigma_g^+$, $v'=0, v''=1$ – second order

TABLE 4. Assignment of the emission lines in CO₂-N₂-H₂O mixture LIDB plasma

Wavelength [nm]	Intensity [arb.u.]	Line identification
358.7	19984	CN, B ² Σ _u ⁺ - X ² Σ _g ⁺ , v'=1, v''=0
385.2	57786	CN, B ² Σ _u ⁺ - X ² Σ _g ⁺ , v'=4, v''=4
385.6	54564	CN, B ² Σ _u ⁺ - X ² Σ _g ⁺ , v'=3, v''=3
386.3	57838	CN, B ² Σ _u ⁺ - X ² Σ _g ⁺ , v'=2, v''=2
387.3	67539	CN, B ² Σ _u ⁺ - X ² Σ _g ⁺ , v'=1, v''=1
388.4	77637	CN, B ² Σ _u ⁺ - X ² Σ _g ⁺ , v'=0, v''=0
415.2	12469	CN, B ² Σ _u ⁺ - X ² Σ _g ⁺ , v'=5, v''=6
415.8	12377	CN, B ² Σ _u ⁺ - X ² Σ _g ⁺ , v'=4, v''=5
416.7	11829	CN, B ² Σ _u ⁺ - X ² Σ _g ⁺ , v'=3, v''=4
418.1	11670	CN, B ² Σ _u ⁺ - X ² Σ _g ⁺ , v'=2, v''=3
419.7	11377	CN, B ² Σ _u ⁺ - X ² Σ _g ⁺ , v'=1, v''=2
421.5	9189	CN, B ² Σ _u ⁺ - X ² Σ _g ⁺ , v'=0, v''=1
777.3	41770	O I, ⁵ S° - ⁵ P
795.2	47517	O I, ⁵ S° - ⁵ P
818.8	72281	N I, ⁴ P - ⁴ P°
821.7	104742	N I, ⁴ P - ⁴ P°
824.4	62283	N I, ⁴ P - ⁴ P°
833.6	68130	C I, ¹ P° - ¹ S
844.54	57744	O I, ³ S° - ³ P

TABLE 5. Assignment of the emission lines in NH₃-CH₄-H₂-H₂O mixture LIDB plasma

Wavelength [nm]	Intensity [arb.u.]	Line identification
385.2	1450	CN, B ² Σ _u ⁺ -X ² Σ _g ⁺ , v'=4, v''=4
385.5	1318	CN, B ² Σ _u ⁺ -X ² Σ _g ⁺ , v'=3, v''=3
386.2	1511	CN, B ² Σ _u ⁺ -X ² Σ _g ⁺ , v'=2, v''=2
387.2	1462	CN, B ² Σ _u ⁺ -X ² Σ _g ⁺ , v'=1, v''=1
388.2	1434	CN, B ² Σ _u ⁺ -X ² Σ _g ⁺ , v'=0, v''=0
416.7	1400	CN, B ² Σ _u ⁺ -X ² Σ _g ⁺ , v'=3, v''=4
418.1	1546	CN, B ² Σ _u ⁺ -X ² Σ _g ⁺ , v'=2, v''=3
419.8	1539	CN, B ² Σ _u ⁺ -X ² Σ _g ⁺ , v'=1, v''=2
421.7	1549	CN, B ² Σ _u ⁺ -X ² Σ _g ⁺ , v'=0, v''=1
436.5	2101	C ₂ , Swan, D ³ Π _g -A ³ Π _u , v'=4, v''=2
437.1	220	C ₂ , Swan, D ³ Π _g -A ³ Π _u , v'=3, v''=1
438.2	1788	C ₂ , Swan, D ³ Π _g -A ³ Π _u , v'=2, v''=0
468.1	8367	C ₂ , Swan, D ³ Π _g -A ³ Π _u , v'=4, v''=3
470.0	9304	C ₂ , Swan, D ³ Π _g -A ³ Π _u , v'=3, v''=2
471.7	10285	C ₂ , Swan, D ³ Π _g -A ³ Π _u , v'=2, v''=1
473.9	10358	C ₂ , Swan, D ³ Π _g -A ³ Π _u , v'=1, v''=0
485.7	12220	H β, Balmer series, E _{ex} =12.1eV, (² P° - ² D)
509.7	11819	C ₂ , Swan, D ³ Π _g -A ³ Π _u , v'=2, v''=2
512.8	16153	C ₂ , Swan, D ³ Π _g -A ³ Π _u , v'=1, v''=1
516.4	13538	C ₂ , Swan, D ³ Π _g -A ³ Π _u , v'=0, v''=0
546.8	6558	C ₂ , Swan, D ³ Π _g -A ³ Π _u , v'=4, v''=5
550.1	7693	C ₂ , Swan, D ³ Π _g -A ³ Π _u , v'=3, v''=4
553.9	9199	C ₂ , Swan, D ³ Π _g -A ³ Π _u , v'=2, v''=3
558.3	11190	C ₂ , Swan, D ³ Π _g -A ³ Π _u , v'=1, v''=2
563.3	11479	C ₂ , Swan, D ³ Π _g -A ³ Π _u , v'=0, v''=1
656.1	28018	H _α , Balmer series, E _{ex} =12.1eV, (² P° - ² D)