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Calculated Transition Strengths Between the Configurations $5d^86s$ and $5d^86p$ in Au III*

H. Mendlowitz**

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The transition strengths have been calculated for transitions between configurations $5d^8\,6s$ and $5d^8\,6p$ of Au III based upon the wavefunctions given by Shadmi. These strengths have been compared with the estimated intensities given by Iglesias and are found to be in substantial agreement.

Key Words: Au III, calculated transition strengths, configurations $5d^8\,6s$ and $5d^8\,6p$.

1. Introduction

Shadmi [1] recently calculated the energy levels of the third spectrum of gold (Au III) for the configurations $5d^9+5d^8\,6s$ and $5d^8\,6p$. He compared his calculations with the observations and classifications of Iglesias [2]. Shadmi found that the *LS* coupling assignments did not fit the levels of Au III. Rather, the levels more closely fitted an intermediate coupling representation which could be fairly well approximated by a *jj* coupling scheme. From the description given by Shadmi, we calculated the transition array between the configurations $5d^8\,6s$ and $5d^8\,6p$.

2. Theory

The strengths of the transitions are defined as in Condon and Shortley [3] by

$$\mathscr{S}(A,B)=\sum_{a,b}|(a|\mathbf{P}|b), \tag{1}$$

where the sum is over all the states which form the sublevels of the levels A and B. We first calculate the square roots of the relative strengths between the two above mentioned configurations in the *LS* representation. We assume that the dipole approximation is valid, so that the transition operator is given by

$$\mathbf{P}=\sum_j e\mathbf{r}_j, \tag{2}$$

where the sum is taken over the electrons involved in the transition. Except for a radial integral factor common to all the matrix elements of the transition array, the matrix elements can be readily calculated [4]. We define $\mathscr{T}_k$ to be the transformation matrix which transforms the energy matrix for the configuration K in the *LS* scheme to the representation where the energy matrix is diagonal, the desired representation. The matrix for the transition from configuration K to configuration K' is then given by

$$\mathscr{M}=\mathscr{T}^+_{K'}\mathscr{M}_{LS}\mathscr{T}_K, \tag{3}$$

where $\mathscr{T}^+$ is the hermitian conjugate of $\mathscr{T}$. $\mathscr{M}_{LS}$ is the matrix for the transition in the *LS* representation and $\mathscr{M}$ is the matrix in the required representation. In eq (3), we employed the same transformation matrices, $\mathscr{T}_K$ and $\mathscr{T}_{K'}$, that Shadmi used to diagonalize the energy matrices. The square roots of the relative strengths and their phases for the transition array d^2s-d^2p, which are the complements of the configurations under consideration here have been treated elsewhere [5] and were utilized for our calculations here.

We find that for the most part our calculated relative strengths agree fairly well qualitatively with Iglesias's estimated intensities. Iglesias [6] revised some of the classified levels after Shadmi's publication appeared. Some of the previously "unobserved" transitions with significant strengths (from these calculations) now coincide with observed lines. In table 1 we present for completeness the relative strengths for the complete transition array $5d^86s-5d^8\,6p$ in the intermediate coupling scheme. For each position in the array the upper line corresponds to the relative strength and the next line corresponds to the wavelength of the published lines. The lowest line gives the wavenumber of the transition.

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**Department of Physics, Howard University, 2401-6th St., NW., Washington, D.C. 20001. Consultant Atomic Physics Division, National Bureau of Standards, Washington, D.C. 20234.

TABLE 1. *Relative strengths for complete transition array in the intermediate coupling scheme*

For each position in the array the upper line corresponds to the relative strength and the next line corresponds to the wavelength of the published lines. The lowest line gives the wave number of the transition. The various energy levels of the d^8s and d^8p configurations are identified by the dominant *LS* state with its percentage contribution to the state, (as calculated by Shadmi) as well as the observed energy level. Those energy levels in parentheses are calculated levels.

d^8s d^8p	84% $(^1S)^2S_{1/2}$ (87357.0	91% $(^3P)^2P_{1/2}$ 58327.1	87% $(^3P)^4P_{1/2}$ 49438.9	50% $(^1D)^2D_{3/2}$ 63670.9	49% $(^3P)^2P_{3/2}$ 54133.2	46% $(^1D)^2D_{3/2}$ 40345.6	64% $(^3P)^4P_{3/2}$ 49969.4
48%$(^3P)^2S_{1/2}$ 125846.2	0.004 38489.2	0.48 1481.066 67519.1	0.07 1308.776 76407.3	0.04 1608.348 62175.3	0.01 71713.0	0.0003 85500.6	0.07 75876.8
74%$(^1S)^2P_{1/2}$ (144606.0)	0.62 57249.0	0.001 86278.9	0.0005 95167.1	0.04 80935.1	0.006 90472.8	0.005 104260.4	0.0001 94636.6
34%$(^1D)^2P_{1/2}$ 113749.9	0.0003 26392.9	0.01 55422.8	0.18 64311.0	0.0004 1996.853 50079.0	0.05 59616.7	0.42 73404.3	0.0007 63780.5
45%$(^1D)^2P_{1/2}$ (137443.0)	0.04 50086.0	0.05 79115.9	0.004 88004.1	0.58 73772.1	0.001 83309.8	0.0002 97097.4	0.0003 87473.6
26%$(^3P)^4D_{1/2}$ 104348.3	0.002 16991.3	0.06 2172.200 46021.2	0.40 1821.169 54909.4	0.0 40677.4	0.0003 50215.1	0.20 1562.429 64002.7	0.0002 54378.9
61%$(^3P)^4P_{1/2}$ (108293.0)	0.0001 20936.0	0.01 49965.9	0.02 58854.1	0.006 44622.1	0.18 54159.8	0.01 67947.4	0.44 58323.6
55%$(^3F)^4D_{1/2}$ 122407.0	0.007 35050.0	0.06 1560.550 64079.9	0.0006 72968.1	0.0009 58736.1	0.42 1464.692 68273.8	0.03 82061.4	0.16 1380.498 72437.6

TABLE 1—Continued

d^8s d^8p	84% $(^1S)^2S_{1/2}$ (87357.0)	91% $(^3P)^2P_{1/2}$ 58327.1	87% $(^3P)^4P_{1/2}$ 49438.9	50% $(^1D)^2D_{3/2}$ 63670.9	49% $(^3P)^2P_{3/2}$ 54133.2	46% $(^1D)^2D_{3/2}$ 40345.6	64% $(^3P)^4P_{3/2}$ 49969.4	45% $(^3P)^4P_{5/2}$ 38822.2	45% $(^1D)^2D_{5/2}$ 64244.0	50% $(^3F)^2F_{5/2}$ 52059.6	72% $(^3F)^4F_{5/2}$ 44425.9
26%$(^1D)^2P_{3/2}$ (133181.0)	0.02 45824.0	0.0 74853.9	0.007 83742.1	0.94 69510.1	0.07 79047.8	0.002 92835.4	0.007 83211.6	0.001 94358.8	0.26 68937.0	0.02 81121.4	0.0003 88755.1
80%$(^1S)^2P_{3/2}$ (156369.0)	1.30 69012.0	0.0008 98041.9	0.002 106930.1	0.01 92698.1	0.0 102235.8	0.0 116023.4	0.0 106399.6	0.0002 117546.8	0.02 92125.0	0.004 104309.4	0.0001 111943.1
27%$(^3P)^2P_{3/2}$ 121943.5	0.0005 34586.5	0.009 1571.901 63616.4	0.24 1379.222 72504.6	0.004 58272.6	0.48 1474.707 67810.3	0.0001 81597.9	0.29 1389.388 71974.1	0.0 83121.3	0.15 1733.140 57699.5	0.001 69883.9	0.16 1290.029 77517.6
30%$(^3P)^2D_{3/2}$ 123179.0	0.001 35822.0	0.35 1541.978 64851.9	0.62 1356.109 73740.1	0.02 59508.1	0.02 69045.8	0.0006 82833.4	0.15 1365.949 73209.6	0.04 84356.8	0.02 58935.0	0.11 1406.079 71119.4	0.0006 78753.1
26%$(^1D)^2D_{3/2}$ 95740.0	0.0007 8383.0	0.0001 37412.9	0.02 2159.085 46301.1	0.0001 3117.339 32069.1	0.01 2402.706 41606.8	0.32 1805.235 55394.4	0.01 2184.108 45770.6	0.91 1756.917 56917.8	0.0003 3174.057 31496.0	0.02 2288.626 43680.4	0.04 1948.792 51314.1
47%$(^3F)^2D_{3/2}$ 128250.9	0.001 40893.9	0.01 69923.8	0.01 78812.0	0.29 1548.473 64580.0	0.09 1349.200 74117.7	0.01 87905.3	0.04 1277.442 78281.5	0.003 89428.7	0.76 1562.328 64006.9	0.10 76191.3	0.02 83825.0
35%$(^3P)^2P_{3/2}$ (116892.1)	0.0009 29535.1	0.23 1707.508 58565.0	0.09 1482.510 67453.2	0.003 53221.2	0.42 1593.394 62758.9	0.16 1306.409 76546.5	0.07 1494.266 66922.7	0.16 1280.903 78069.9	0.01 1899.405 52648.1	0.007 64832.5	0.17 1379.951 72466.2
40%$(^3P)^4S_{3/2}$ 127467.6	0.0009 40110.6	0.61 1446.334 69140.5	0.03 78028.7	0.005 63796.7	0.11 73334.4	0.003 87122.0	0.47 1290.358 77498.2	0.01 88645.4	0.003 63223.6	0.07 1326.105 75408.0	0.02 83041.7
20%$(^3P)^4P_{3/2}$ 109387.6	0.0005 22030.6	0.08 1958.472 51060.5	0.20 1668.098 59948.7	0.02 2186.673 45716.7	0.08 1809.811 55254.4	0.58 1448.393 69042.0	0.0002 59418.2	0.18 1417.111 70565.4	0.0 45143.6	0.18 1744.346 57328.0	0.002 64961.7
31%$(^3P)^4D_{3/2}$ 106263.1	0.0007 18906.1	0.04 2085.452 47936.0	0.02 1759.800 56824.2	0.007 2347.105 42592.2	0.04 1918.278 52129.9	0.002 1517.049 65917.5	0.29 1776.396 56293.7	0.01 1482.775 67440.9	0.002 2379.106 42019.1	0.41 1844.889 54203.5	0.50 1617.137 61837.2
29%$(^1D)^2P_{3/2}$ 118561.7	0.003 31204.7	0.005 60234.6	0.10 1446.701 69122.8	0.04 1821.801 54890.8	0.004 64428.5	0.26 1278.514 78216.1	0.002 68592.3	0.009 79739.5	0.10 1841.019 54317.7	0.40 1503.716 66502.1	0.41 1348.873 74135.8

Table 1—Continued

d^8s d^8p	50% $(^1\mathrm{D})^2\mathrm{D}_{3/2}$ 63670.9	49% $(^3\mathrm{P})^2\mathrm{P}_{3/2}$ 54133.2	46% $(^1\mathrm{D})^2\mathrm{D}_{3/2}$ 40345.6	64% $(^3\mathrm{P})^4\mathrm{P}_{3/2}$ 49969.4	45% $(^3\mathrm{P})^4\mathrm{P}_{5/2}$ 38822.2	45% $(^1\mathrm{D})^2\mathrm{D}_{5/2}$ 64244.0	50% $(^3\mathrm{F})^2\mathrm{F}_{5/2}$ 52059.6	72% $(^3\mathrm{F})^4\mathrm{F}_{5/2}$ 44425.9	56% $(^3\mathrm{F})^2\mathrm{F}_{7/2}$ 45740.5	58% $(^3\mathrm{F})^4\mathrm{F}_{7/2}$ 35076.7	93% $(^1\mathrm{G})^2\mathrm{G}_{7/2}$ 58584.6
26%$(^1\mathrm{D})^2\mathrm{F}_{5/2}$ 96094.5	0.0009 32423.6	0.03 2382.403 41961.3	0.70 1793.762 55748.9	0.01 2167.332 46125.1	1.04 1746.037 57272.3	0.0 3138.730 31850.5	0.005 2270.217 44034.9	0.02 1935.416 51668.6	0.005 1985.951 50354.0	0.18 1638.876 61017.8	0.004 2665.159 37509.9
29%$(^3\mathrm{P})^4\mathrm{P}_{5/2}$ 107554.2	0.01 2278.045 43883.3	0.06 1871.922 53421.0	0.87 1487.906 67208.6	0.08 1736.590 57584.8	0.49 1454.927 68732.0	0.008 2308.200 43310.2	0.26 1801.982 55494.6	0.03 1584.074 63128.3	0.18 1617.761 61813.7	0.005 72477.5	0.01 2041.435 48969.6
28%$(^1\mathrm{D})^2\mathrm{D}_{5/2}$ 134953.0	0.68 1402.878 71282.1	0.05 80819.8	0.0 94607.4	0.01 84983.6	0.0001 96130.8	0.93 1414.247 70709.0	0.005 82893.4	0.0002 90527.1	0.01 89212.5	0.002 99876.3	0.32 1309.440 76368.4
44%$(^3\mathrm{F})^2\mathrm{D}_{5/2}$ 108221.2	0.008 44550.3	0.16 1848.833 54088.0	0.05 1473.279 67875.6	0.13 1716.697 58251.8	0.0003 69399.0	0.005 43977.2	0.26 1780.571 56161.6	0.24 1567.512 63795.3	0.43 1600.496 62480.7	0.72 1367.149 73144.5	0.004 49636.6
42%$(^3\mathrm{P})^4\mathrm{D}_{5/2}$ (125580.0)	0.15 61909.1	1.28 71446.8	0.03 85234.4	0.13 75610.6	0.0006 86757.8	0.05 61336.0	0.13 73520.4	0.15 81154.1	0.03 79839.5	0.007 90503.3	0.05 66935.4
45%$(^3\mathrm{F})^4\mathrm{D}_{5/2}$ 101728.2	0.0007 38057.3	0.002 2100.392 47595.0	0.11 1629.116 61382.6	0.07 1932.038 51758.8	0.07 1589.680 62906.0	0.01 2666.994 37484.2	0.002 49668.6	0.21 1745.098 57302.3	0.66 1786.106 55987.7	0.87 1500.334 66651.5	0.002 43143.6
30%$(^3\mathrm{F})^2\mathrm{D}_{5/2}$ 112879.6	0.003 49208.7	0.21 1702.235 58746.4	0.19 1378.655 72534.0	0.56 1589.559 62910.2	0.34 1350.302 74057.4	0.04 2055.459 48635.6	0.15 1644.189 60820.0	0.01 68453.7	0.35 1489.446 67139.1	0.14 1285.302 77802.9	0.0003 54295.0
35%$(^3\mathrm{F})^2\mathrm{F}_{5/2}$ 122530.3	0.60 1698.970 58859.4	0.11 1462.048 68397.1	0.003 82184.7	0.34 1378.166 72560.9	0.0005 83708.1	0.56 1715.670 58286.3	0.25 1419.023 70470.7	0.03 78104.4	0.05 76789.8	0.03 87453.6	0.04 1563.826 63945.7
70%$(^1\mathrm{G})^2\mathrm{F}_{5/2}$ 128512.7	0.25 1542.212 64841.8	0.003 74379.5	0.003 88167.1	0.007 78543.3	0.002 89690.5	0.10 64268.7	0.09 1307.988 76453.1	0.02 84086.8	0.0001 82772.2	0.002 93436.0	1.52 1430.037 69928.1
26%$(^3\mathrm{P})^4\mathrm{P}_{5/2}$ 120027.3	0.25 1774.419 56356.4	0.02 65894.1	0.05 1254.996 79681.7	0.56 1427.393 70057.9	0.02 81205.1	0.29 1792.653 55783.3	0.68 1471.281 67967.7	0.04 1322.728 75601.4	0.04 1346.129 74286.8	0.05 84950.6	0.002 61442.7
29%$(^3\mathrm{F})^4\mathrm{D}_{5/2}$ 115374.2	0.04 1934.114 51703.3	0.08 1632.891 61241.0	0.0003 75028.6	0.10 1528.941 65404.8	0.03 1306.317 76552.0	0.02 51130.2	0.18 1579.413 63314.6	1.25 1409.472 70948.3	0.24 1436.088 69633.7	0.001 80297.5	0.05 1760.881 56789.6

TABLE 1 – Continued

d^8s / d^8p	45% $(^3P)^4P_{5/2}$ 38822.2	45% $(^1D)^2D_{5/2}$ 64244.0	50% $(^3F)^2F_{5/2}$ 52059.6	72% $(^3F)^4F_{5/2}$ 44425.9	56% $(^3F)^2F_{7/2}$ 45740.5	58% $(^3F)^4F_{7/2}$ 35076.7	93% $(^1G)^2G_{7/2}$ 58584.6	96% $(^3F)^4F_{9/2}$ 29753.6	96% $(^1G)^2G_{9/2}$ 57818.6
44%$(^1D)^2F_{7/2}$ 110984.1	2.19 1385.763 72161.9	0.0006 46740.1	0.12 1697.081 58924.5	0.10 1502.441 66558.2	0.0004 65243.6	0.11 75907.4	0.0 52399.5	0.10 1231.060 81230.5	0.05 1880.911 53165.5
63%$(^3F)^4D_{7/2}$ 88788.5	0.03 49966.3	0.0004 24544.5	0.008 2721.835 36728.9	0.01 2253.448 44362.6	0.05 2322.267 43048.0	0.29 1861.799 53711.8	0.002 3309.856 30203.9	2.27 1693.917 59034.9	0.006 3227.991 30969.9
48%$(^1D)^2F_{7/2}$ (135014.0)	0.004 96191.8	2.51 70770.0	0.05 82954.4	0.01 90588.1	0.007 89273.5	0.0 99937.3	0.02 76429.4	0.001 105260.4	0.06 77195.4
59%$(^3F)^4G_{7/2}$ 102320.2	0.28 1574.855 63498.0	0.01 2625.522 38076.2	0.16 1989.631 50260.6	0.77 1727.281 57894.3	0.46 1767.415 56579.7	0.94 1487.133 67243.5	0.0 43735.6	0.05 1378.048 72566.6	0.001 44501.6
42%$(^1G)^2F_{7/2}$ 118324.6	0.0001 79502.4	0.04 1849.088 54080.6	0.009 66265.0	0.29 1353.200 73898.7	0.79 1377.708 72584.1	0.007 83247.9	0.26 1673.919 59740.0	0.03 88571.0	1.25 1652.733 60506-0
47%$(^3F)^4F_{7/2}$ 116293.8	0.10 1290.795 77471.6	0.0 52049.8	0.03 1556.793 64234.2	0.69 1391.441 71867.9	0.75 1417.368 70553.3	0.13 1231.266 81217.1	0.05 57709.2	0.002 86540.2	0.91 1710.125 58475.2
44%$(^3P)^4D_{7/2}$ 121826.4	0.03 83004.2	0.04 57582.4	2.24 1433.344 69766.8	0.22 1291.979 77400.5	0.04 76085.9	0.02 86749.7	0.04 1581.226 63241.8	0.03 1086.110 92072.8	0.01 1562.328 64007.8
74%$(^1G)^2G_{7/2}$ 130978.2	0.0006 92156.0	0.06 66734.2	0.02 78918.6	0.0004 86552.3	0.04 85237.7	0.009 95901.5	2.29 1381.338 72393.6	0.0 101224.6	0.25 1366.874 73159.6
61%$(^3F)^2F_{7/2}$ 105809.1	0.04 1492.829 66986.9	0.009 2405.118 41565.1	0.03 1860.484 53749.5	0.57 1629.116 61383.2	0.53 1664.778 60068.6	1.16 1413.779 70732.4	0.0004 2116.879 47224.5	0.20 1314.825 76055.5	0.13 2083.092 47990.5

d^8s / d^8p	56% $(^3F)^2F_{7/2}$ 45740.5	58% $(^3F)^4F_{7/2}$ 35076.7	93% $(^1G)^2G_{7/2}$ 58584.6	96% $(^3F)^4F_{9/2}$ 29753.6	96% $(^1G)^2G_{9/2}$ 57818.6
36%$(^3F)^2G_{9/2}$ 91409.4	0.15 2188.966 45668.9	1.77 1775.166 56332.7	0.0003 32824.8	1.42 1621.913 61655.8	0.0002 33590.8
66%$(^3F)^4F_{9/2}$ 104564.6	0.12 1699.990 58824.1	1.30 1439.100 69487.9	0.0003 45980.0	1.91 1336.700 74811.0	0.0 46746.0
82%$(^1G)^2G_{9/2}$ 132353.0	0.0 86612.5	0.0 97276.3	0.88 1355.598 73768.4	0.0 102599.4	2.45 1341.660 74534.4
43%$(^3F)^4G_{9/2}$ 115724.2	2.35 1428.907 69983.7	0.21 1239.961 80647.5	0.57 1750.095 57139.6	0.0 85970.6	0.20 1726.952 57905.6
68%$(^1G)^2H_{9/2}$ (115091.0)	0.72 69350.5	0.06 80014.3	1.88 56506.4	0.0009 85337.4	0.68 57272.4

d^8s / d^8p	96% $(^3F)^4F_{9/2}$ 29753.6	96% $(^1G)^2G_{9/2}$ 57818.6
95%$(^3F)^4G_{11/2}$ (102993.7)	4.00 1365.372 73240.1	0.003 45175.1
95%$(^1G)^2H_{11/2}$ (127467.0)	0.003 97713.4	4.00 1435.784 69648.4

In table 2 we list the strengths as a function of wavelength. The wavelength is listed in the first column in angstroms, the wavenumber (in cm^{-1}) is given in the second column for unreported transitions or for transitions which have been reclassified by Iglesias, the third and fourth column list the statistical weights for the lower and upper states respectively, and in the last column we list the strength of the transition. Transitions between one or more levels which have not been observed are not listed in this table.

The relative strengths are given in general to two decimal places on the scale where the radial integral factor is normalized to unity. The approximations in the present calculation would, for the most part, preclude any real significance to more decimal places. However, in table 1 we have included strengths which are less than 0.01 to indicate orders of magnitude. We have also included strengths which are less than 0.01 in table 2 only for those lines which have been observed. A strength with a value of 0.0 indicates that on our scale it is less than 5×10^{-5}. In most cases we find that the larger values of the strengths correspond to the transitions observed by Iglesias. There are very few observed lines below 2000 Å with strengths less than 0.04. Beyond 2000 Å there are only a few lines with strengths of the order of 0.001 or less. This indicates that the wave functions obtained by Shadmi are quite good and the identification of the energy levels is in substantial agreement with Iglesias's revised classification.

TABLE 2. *The calculated line strengths as a function of wavelength*

We list in the first column the wavelength in Å, in the second column the wave number in cm^{-1}, in the third and fourth columns the statistical weights of the lower and upper states, and in the last column the relative strengths.

The wave numbers with an asterisk are the results due to the modification made by Iglesias [6].

The wavelengths with † are calculated values, others are observed.

λ	1/λ	g_L $(2J_l+1)$	g_u $(2J_u+1)$	S
Å	cm^{-1}			
1086.11		10	8	0.03
† 1103.88	90589.5	6	8	0.01
† 1120.92	89212.5	8	6	0.01
† 1128.09	88645.4	6	4	0.01
† 1129.04	88571.0	10	8	0.03
† 1137.59	87905.3	4	4	0.01
† 1143.46	87453.6	8	6	0.03
† 1152.74	86749.7	8	8	0.02
† 1170.65	* 85422.3	4	6	0.03
† 1173.19	85237.7	8	8	0.04
† 1177.15	84950.6	8	6	0.05
† 1185.44	84356.8	6	4	0.04
† 1189.25	84086.8	6	6	0.02
† 1192.96	83825.0	6	4	0.02
† 1204.21	83041.7	6	4	0.02
† 1204.76	83004.2	6	8	0.03
1207.26	* 82831.5	6	8	0.05
† 1218.60	82061.4	4	2	0.03
1229.36	* 81342.0	6	6	0.15
1231.06		10	8	0.10
1231.27		8	8	0.13
† 1231.45	81205.1	6	6	0.02
† 1232.79	* 80999.3	6	4	0.02
† 1237.32	80819.8	4	6	0.05
1239.96		8	10	0.21
† 1245.90	* 80263.2	8	10	0.06
† 1249.57	* 80027.4	8	6	0.03
1255.00		4	6	0.05
1259.81	* 79378.6	2	2	0.05
† 1267.01	* 78925.7	4	4	0.07
† 1267.13	78918.6	6	8	0.02
† 1268.84	78812.0	2	4	0.01
1277.44		4	4	0.04
1278.51		4	4	0.26
† 1280.34	78104.4	6	6	0.03
1280.90		6	4	0.16
† 1281.58	78028.7	2	4	0.03
1285.30		8	6	0.14
1290.03		6	4	0.16
1290.36		4	4	0.47
1290.80		6	8	0.10
1291.98		6	8	0.22
1297.49	* 77072.5	10	8	0.06
† 1302.26	76789.8	8	6	0.05
1306.32		6	6	0.03
1306.41		4	4	0.16
1307.99		6	6	0.09
1308.78		2	2	0.07
1309.44		8	6	0.32
1310.49	* 76306.5	8	8	0.02
† 1312.49	76191.3	6	4	0.10
† 1314.30	76085.9	8	8	0.04
1314.83		10	8	0.20
† 1317.39	75907.4	8	8	0.11
† 1317.93	75876.8	4	2	0.07
† 1319.28	* 75798.5	4	6	0.13
1322.73		6	6	0.03
1326.11		6	4	0.07
1336.70		10	10	1.91
1341.66		10	10	2.45
1346.13		8	6	0.04
1348.87		6	4	0.41
1349.20		4	4	0.09
1350.30		6	6	0.34
1350.72	* 74034.8	4	2	0.58
1353.20		6	8	0.29
1355.60		8	10	0.88
1356.11		2	4	0.62
† 1356.69	* 73708.3	6	6	0.13
1362.04	* 73419.3	4	2	0.42
† 1363.62	73334.4	4	4	0.11
1365.37		10	12	4.00
1365.95		4	4	0.15
1366.87		10	8	0.25
1367.15		8	6	0.72
1377.71		8	8	0.79
1378.05		10	8	0.05
1378.17		4	6	0.34
1378.66		4	6	0.19
1379.22		2	4	0.24
1379.95		6	4	0.17
1380.50		4	2	0.16
1381.34		8	8	2.29
1385.76		6	8	2.19
1389.39		4	4	0.29
1391.44		6	8	0.69
† 1394.45	71713.0	4	2	0.01
1395.97	* 71634.7	4	6	1.28
1402.88		4	6	0.68
1406.08		6	4	0.11
1409.47		6	6	1.25
1413.78		8	8	1.16
1414.25		6	6	0.93
1415.49	* 70647.1	6	8	2.51
1417.11		6	4	0.18
1417.37		8	8	0.75
1419.02		6	6	0.25
1427.39		4	6	0.56
1428.91		8	10	2.35
1430.04		8	6	1.52
† 1430.13	69923.8	2	4	0.01
1433.34		6	8	2.24
1435.78		10	12	4.00
1436.09		8	6	0.24
1436.80	* 69599.4	8	10	0.72
1439.10		8	10	1.30
1441.17	* 69388.0	4	4	0.94
1446.33		2	4	0.61
1446.70		2	4	0.10

TABLE 2. *The calculated line strengths as a function of wavelength*

We list in the first column the wavelength in Å, in the second column the wave number in cm^{-1}, in the third and fourth columns the statistical weights of the lower and upper states, and in the last column the relative strengths.

The wave numbers with an asterisk are the results due to the modification made by Iglesias [6].

The wavelengths with † are calculated values, others are observed.

λ	1/λ	g_L ($2J_l+1$)	g_u ($2J_u+1$)	S
Å	*cm*$^{-1}$			
† 1448.31	69045.8	4	4	0.02
1448.39		4	4	0.58
1453.17	* 68814.9	6	4	0.26
1454.93		6	6	0.49
† 1460.84	68453.7	6	6	0.01
1462.05		4	6	0.11
1464.69		4	2	0.42
1471.28		6	6	0.68
1473.28		4	6	0.05
† 1474.10	* 67837.6	4	2	0.01
1474.71		4	4	0.48
1481.07		2	2	0.48
1482.51		2	4	0.09
1482.78		6	4	0.01
1487.13		8	8	0.94
1487.91		4	6	0.87
† 1488.46	* 67183.3	8	6	0.05
1489.45		8	6	0.35
1492.83		6	8	0.04
1494.27		4	4	0.07
† 1498.48	66734.2	6	8	0.06
1500.33		8	6	0.87
1502.44		6	8	0.10
1503.72		6	4	0.41
1517.05		4	4	0.002
† 1517.59	65894.1	4	6	0.02
1528.94		4	6	0.10
1541.98		2	4	0.35
1542.21		4	6	0.25
1548.47		4	4	0.29
1554.58	* 64326.0	2	2	0.18
† 1555.97	64268.7	6	6	0.10
1556.79		6	8	0.03
1560.55		2	2	0.06
1562.33		10	8	0.01
1562.33		6	4	0.76
1562.43		4	2	0.21
1563.83		8	6	0.04
1567.51		6	6	0.24
1571.90		2	4	0.01
1574.86		6	8	0.28
1579.41		6	6	0.18
1581.23		8	8	0.05
1584.07		6	6	0.03
1589.56		4	6	0.56
1589.68		6	6	0.07
1593.39		4	4	0.42
1600.50		8	6	0.43
1608.35		4	2	0.04
1610.39	* 62097.0	4	6	0.15
1617.14		6	4	0.50
1617.76		8	6	0.18
1621.91		10	10	1.42
1625.38	* 61523.9	6	6	0.05
1629.12		4	6	0.11
1629.12		6	8	0.57
1632.89		4	6	0.08
1638.88		8	6	0.18
1644.19		6	6	0.15
1652.73		10	8	1.25
1664.78		8	8	0.53
1668.10		2	4	0.20
1673.92		8	8	0.26
1676.96	* 59631.7	4	2	0.05
† 1680.44	59508.1	4	4	0.02
1693.92		10	8	2.27
† 1696.78	58935.0	6	4	0.02
1697.08		6	8	0.12
1698.97		4	6	0.60
1699.99		8	10	0.12
1702.24		4	6	0.21
† 1702.29	* 58744.3	2	2	0.02
1707.51		2	4	0.23
1710.13		10	8	0.91
1715.67		6	6	0.56
1716.70		4	6	0.13
1717.83	* 58213.8	4	2	0.44
1726.95		10	10	0.20
1727.28		6	8	0.77
† 1732.83	57709.2	8	8	0.05
1733.14		6	4	0.15
1736.59		4	6	0.08
† 1736.64	57582.4	6	8	0.04
1738.48	* 57521.3	10	10	0.68
1744.35		6	4	0.18
1745.10		6	6	0.21
1746.04		6	6	1.04
1750.10		8	10	0.57
1756.92		6	4	0.91
1759.80		2	4	0.02
1760.88		8	6	0.05
1761.95	* 56755.3	8	10	1.88
1767.42		8	8	0.46
1774.42		4	6	0.25
1775.17		8	10	1.77
1776.40		4	4	0.29
1780.57		6	6	0.26
1786.11		8	6	0.66
1792.65		6	6	0.29
1793.76		4	6	0.70
1801.98		6	6	0.26
† 1803.82	* 55437.8	2	2	0.01
1805.24		4	4	0.32
1809.81		4	4	0.08
1821.17		2	2	0.40
1821.80		4	4	0.04
1841.02		6	4	0.10
1844.89		6	4	0.41
1848.83		4	6	0.16
1849.09		6	8	0.04
1850.15	* 54050.0	4	2	0.18
1860.48		6	8	0.03
1861.80		8	8	0.29
1871.92		4	6	0.06
1880.91		10	8	0.05
1899.41		6	4	0.01
1918.28		4	4	0.04
1932.04		4	6	0.07
1934.11		4	6	0.04
1935.42		6	6	0.02
1948.79		6	4	0.04
† 1955.79	51130.2	6	6	0.02
1958.47		2	4	0.08
1985.95		8	6	0.005
† 1986.14	* 50348.7	2	2	0.04
1989.63		6	8	0.16
† 2001.35	49966.3	6	8	0.03
2005.76	* 49856.1	2	2	0.01
2041.44		8	6	0.01
2055.46		6	6	0.04
2083.09		10	8	0.13
2085.45		2	4	0.04
2100.39		4	6	0.002
2116.88		8	8	0.0004
2159.09		2	4	0.02
2167.33		4	6	0.01
2172.20		2	2	0.06
2184.11		4	4	0.01
2186.67		4	4	0.02
† 2188.09	* 45701.9	2	4	0.02
2188.97		8	10	0.15
2253.45		6	8	0.01
2270.22		6	6	0.005
2278.05		4	6	0.01
2288.63		6	4	0.02
2308.20		6	6	0.008
2322.27		8	8	0.05
2347.11		4	4	0.007
2379.11		6	4	0.002
2382.40		4	6	0.03

TABLE 2. *The calculated line strengths as a function of wavelength.*—Continued

We list in the first column the wavelength in Å, in the second column the wave number in cm^{-1}, in the third and fourth columns the statistical weights of the lower and upper states, and in the last column the relative strengths.

The wave numbers with an asterisk are the result due to the modification made by Iglesias [6].

The wavelengths with † are calculated values, others are observed.

λ	$1/\lambda$	g_L $(2J_l+1)$	g_u $(2J_u+1)$	S
Å	cm^{-1}			
2402.71		4	4	0.01
2405.12		6	8	0.009
2625.52		6	8	0.01
2665.16		8	6	0.004
2666.99		6	6	0.01
2721.84		6	8	0.008
3117.34		4	4	0.0001
3138.73		6	6	0.0000
3174.06		6	4	0.0003
3227.99		10	8	0.006
3309.86		8	8	0.002

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