# CLASSIFIED LINES IN THE SPECTRUM OF Xe II

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## ABSTRACT

The spectrum of xenon emitted by a non-conventional light source has been studied. About 123 lines are classified in the range 2100 - 6750 Å.

## RESUMEN

Ha sido estudiado el espectro del xenón emitido por una fuente luminosa no convencional. Son clasificadas alrededor de 123 líneas en el rango de 2100 - 6750 Å.

## 1. INTRODUCTION

Reyna Almandos et al (1) recently reported results in the spectrum of singly ionized xenon. About 40 lines were classified in the 2000 - 2800 Å range belonging to 6s-4f and 5d-4f transitions.

An extended compilation of lines of the xenon spectra by Gallardo and Reyna Almandos (2) shows that there are many unclassified lines distributed throughout the whole wavelength range investigated.

The present work has made use of this compilation and additional material for classifying 123 lines corresponding to 5d-6f, 6s-7p, 5d-7p, 6s-6p, 4f-5g, 8s-6p, 7s-4f, 6s-4f, 5d-4f, 5d-5f, 5d-6p, 6d-4f, 6d-5g, 6p-7s, 6p-8s, 6p-5g, 6p-6g, 6p-6d, 6p-5d, 7p-5g, 7p-8s, 7p-6d, 4f-6g and 4f-7g transitions.

## 2. EXPERIMENTAL METHODS

All spectra were produced in pure xenon confined in a tube originally designed for pulsed laser operation. The light source is similar to that described by Reyna Almandos et al (1).

Spectrograms were recorded using thorium (3) as a reference spectrum, and the probable wavelength error seldom exceeds 0.05 Å, 0.03 Å and 0.01 Å for lines measured in the first, second and third diffraction orders respectively.

Systematic shifts, resulting from the use of a non-conventional light source, were frequently found.

A comparation between lines measured by Humphreys (4) and those determined with our source revealed shifts that are different for different transitions, the maximum differences $\sigma_{obs} - \sigma_{Humphreys}$ being about $+0.6\ cm^{-1}$ corresponding to 6p-6d and 6p-7s transitions. However, greater shifts can be observed in other transitions, but not systematically.

Full experimental details are given in (1), which also assign 50 new lines to Xe II spectra.

## 3. RESULTS

Not only the wavelengths listed in (2) but also a number of lines corresponding to unpublished material (5,6) has been used for classifying the Xe II lines. Part of this matrial (6) contains new lines and the revised ionic assignation of a group of lines that is reported as Xe II or Xe II-III in (2).

All Xe II lines were classified in accordance with data obtained in AEL (7) and modifications proposed by Hansen and Person (8) are given in Table I. The third and fourth columns of the table give the wavenumber of the lines and show the degree of agreement between observed and calculated values taking into account the shifts in our lines.

## TABLE I

*Classified Xe II Lines in the Region 2100–6800* Å
Comments of lines shapes: A = asymetric; B = blended; H = wide
Symbols in column five; a = unpublished material (5,6); b = revised assignation

| Intensity and shape | Wavelength (Å) | Wavenumber ($cm^{-1}$) | | Classification | Comment |
|---|---|---|---|---|---|
| | | Observed | Calculated | | |
| 0A | 2108.24 | 47417.95 | 8.97 | $(^3P_1)5d[3]_{7/2}-(^3P_2)6f[5]_{9/2}$ | |
| 0A | 2142.25 | 46665.23 | .45 | $(^3P_2)6s[2]_{5/2}-(^3P_2)7p[3]_{7/2}$ | |
| 0A | 2146.31 | 46576.97 | 7.54 | $(^3P_2)6s[2]_{5/2}-(^3P_2)7p[3]_{5/2}$ | |
| 1 | 2170.40 | 46060.06 | .34 | $(^3P_2)6s[2]_{5/2}-(^3P_2)7p[2]_{5/2}$ | |
| 2 | 2171.64 | 46033.76 | .43 | $(^3P_2)5d[4]_{7/2}-(^3P_0)4f[3]_{7/2}$ | |
| 0 | 2192.78 | 45590.00 | .15 | $(^3P_2)5d[2]_{5/2}-(^3P_2)7p[2]_{3/2}$ | |
| 1 | 2193.48 | 45575.46 | 6.33 | $(^3P_2)6p[2]_{3/2}-(^3P_1)8s[1]_{1/2}$ | |
| 0 | 2224.29 | 44944.14 | 3.61 | $(^3P_2)6p[2]_{5/2}-(^3P_2)6g[3]_{5/2}$ | a |
| | | | 5.32 | $(^3P_2)6p[2]_{5/2}-(^3P_2)6g[3]_{7/2}$ | |
| 1 | 2254.74 | 44337.32 | .15 | $(^3P_2)5d[2]_{5/2}-(^3P_2)7p[3]_{7/2}$ | |
| 2 | 2256.82 | 44296.46 | .22 | $(^3P_2)5d[3]_{7/2}-(^3P_2)7p[3]_{7/2}$ | |
| 0 | 2261.33 | 44208.12 | .31 | $(^3P_2)5d[3]_{7/2}-(^3P_2)7p[3]_{5/2}$ | |
| 3 | 2264.99 | 44136.69 | .45 | $(^3P_1)5d[2]_{3/2}-(^1D_2)4f[1]_{3/2}$ | |
| 1 | 2273.18 | 43977.69 | 8.10 | $(^3P_2)5d[2]_{3/2}-(^3P_2)7p[2]_{3/2}$ | |
| 3 | 2273.37 | 43974.02 | .63 | $(^3P_1)5d[1]_{1/2}-(^1S_0)6p[1]_{1/2}$ | |
| 0B | 2282.60 | 43796.22 | 7.06 | $(^3P_2)5d[2]_{5/2}-(^3P_2)7p[1]_{3/2}$ | |
| 2 | 2287.92 | 43694.39 | 5.61 | $(^3P_2)6p[1]_{1/2}-(^3P_1)8s[1]_{1/2}$ | |
| 1B | 2314.21 | 43198.05 | 7.10 | $(^3P_2)6p[3]_{7/2}-(^3P_2)6g[3]_{5/2}$ | |
| | | | .81 | $(^3P_2)6p[3]_{7/2}-(^3P_2)6g[3]_{7/2}$ | |
| 2 | 2316.27 | 43159.64 | 60.32 | $(^3P_2)5d[2]_{3/2}-(^3P_2)7p[1]_{3/2}$ | |
| 0 | 2321.54 | 43061.67 | .77 | $(^3P_2)5d[1]_{3/2}-(^3P_1)4f[2]_{3/2}$ | |
| 0B | 2362.90 | 42307.99 | .05 | $(^1D_2)5d[4]_{7/2}-(^1D_2)4f[3]_{5/2}$ | |
| 0 | 2364.13 | 42285.98 | .57 | $(^3P_1)6s[1]_{1/2}-(^1S_0)6p[1]_{3/2}$ | |
| 0 | 2364.63 | 42277.04 | .14 | $(^3P_2)5d[0]_{1/2}-(^1S_0)6p[1]_{1/2}$ | |

| | | | | |
|---|---|---|---|---|
| 0 | 2369.03 | 42198.52 | 7.41 | $(^1D_2)5d[4]_{9/2}-(^1D_2)4f[3]_{7/2}$ |
| 0 | 2379.11 | 42019.74 | .48 | $(^3P_2)6p[2]_{5/2}-(^1D_2)6d[3]_{7/2}$ |
| 1 | 2404.84 | 41570.20 | .06 | $(^3P_0)5d[2]_{3/2}-(^3P_1)4f[2]_{5/2}$ |
| 0 | 2419.50 | 41318.34 | .57 | $(^3P_1)6s[1]_{1/2}-(^1S_0)6p[1]_{1/2}$ |
| 1 | 2442.54 | 40928.62 | .06 | $(^1D_2)5d[4]_{7/2}-(^3P_2)6f[5]_{9/2}$ |
| 0 | 2446.79 | 40857.54 | .33 | $(^3P_1)5d[3]_{7/2}-(^3P_1)4f[4]_{7/2}$ |
| 1 | 2479.40 | 40320.20 | .19 | $(^3P_1)5d[1]_{3/2}-(^1S_0)6p[1]_{1/2}$ |
| 0 | 2509.98 | 39829.00 | .41 | $(^3P_0)6s[0]_{1/2}-(^3P_2)7p[2]_{3/2}$ |
| 1 | 2523.97 | 39608.25 | 9.25 | $(^3P_0)6p[1]_{3/2}-(^3P_1)5g[3]_{5/2}$ |
| 0 | 2553.79 | 39145.78 | 6.03 | $(^3P_1)6d[3]_{7/2}-(^3P_0)4f[3]_{7/2}$ |
| 0 | 2572.93 | 38854.59 | 5.35 | $(^3P_2)6s[2]_{5/2}-(^1D_2)6p[2]_{3/2}$ |
| 0 | 2617.14 | 38198.22 | .22 | $(^3P_2)5d[4]_{7/2}-(^3P_2)7p[3]_{7/2}$ |
| 2 | 2623.17 | 38110.48 | .31 | $(^3P_2)5d[4]_{7/2}-(^3P_2)7p[3]_{5/2}$ |
| 1 | 2640.54 | 37859.80 | .21 | $(^3P_2)6p[3]_{7/2}-(^3P_2)5g[2]_{5/2}$ |
| 1 | 2648.83 | 37741.32 | .21 | $(^3P_2)6p[3]_{7/2}-(^3P_2)5g[4]_{7/2}$ |
| 0 | 2683.72 | 37250.68 | 9.33 | $(^3P_2)6p[1]_{3/2}-(^1D_2)6d[2]_{5/2}$ |
| 1 | 2693.18 | 37119.81 | 20.38 | $(^1D_2)6s[2]_{3/2}-(^3P_1)4f[3]_{5/2}$ |
| 0 | 2698.39 | 37048.18 | .14 | $(^3P_1)5d[2]_{3/2}-(^3P_1)4f[2]_{3/2}$ |
| 0 | 2705.38 | 36952.46 | 3.63 | $(^3P_0)6p[1]_{1/2}-(^3P_1)8s[1]_{1/2}$ |
| 1 | 2709.34 | 36898.45 | 7.73 | $(^3P_1)5d[2]_{3/2}-(^1S_0)6p[1]_{1/2}$ |
| 1 | 2712.17 | 36859.95 | .41 | $(^3P_2)6s[2]_{3/2}-(^1D_2)6p[2]_{3/2}$ |
| 0 | 2751.76 | 36329.67 | .71 | $(^3P_1)6s[1]_{3/2}-(^3P_2)7p[2]_{5/2}$ |
| 0 | 2762.25 | 36191.71 | 90.75 | $(^3P_1)5d[2]_{3/2}-(^3P_0)4f[3]_{5/2}$ |
| 0 | 2840.64 | 35193.02 | 1.70 | $(^1D_2)5d[4]_{9/2}-(^3P_2)5f[5]_{11/2}$ |
| 1 | 2954.41 | 33837.85 | .30 | $(^3P_1)6p[2]_{3/2}-(^3P_1)8s[1]_{3/2}$ |

TABLE I (Continued)

| | | | | |
|---|---|---|---|---|
| 0 | 2958.50 | 33791.07 | .67<br>89.96 | $(^3P_1)6p[2]_{5/2}-(^3P_2)6g[3]_{7/2}$<br>$(^3P_1)6p[2]_{5/2}-(^3P_2)6g[3]_{5/2}$ |
| 0 | 2973.21 | 33623.90 | 4.02 | $(^3P_1)5d[3]_{5/2}-(^3P_1)4f[2]_{3/2}$ |
| 0B | 3009.03 | 33223.65 | 2.46 | $(^3P_2)6p[3]_{7/2}-(^3P_1)6d[3]_{5/2}$ |
| 2 | 3022.06 | 33080.41 | 79.05 | $(^3P_1)6p[1]_{3/2}-(^3P_1)8s[1]_{1/2}$ |
| 0 | 3047.56 | 32803.62 | .93 | $(^3P_0)5d[2]_{3/2}-(^3P_2)4f[1]_{1/2}$ |
| 1 | 3055.50 | 32718.38 | .59 | $(^3P_2)5d[3]_{5/2}-(^3P_2)7p[1]_{3/2}$ |
| 0 | 3142.54 | 31812.21 | .06 | $(^3P_0)5d[2]_{3/2}-(^3P_2)7p[1]_{3/2}$ |
| 3 | 3150.97 | 31727.10 | 6.61 | $(^3P_0)5d[2]_{5/2}-(^3P_2)7p[3]_{7/2}$ |
| 0 | 3194.85 | 31291.36 | 90.33<br>90.84 | $(^1D_2)6p[3]_{7/2}-(^3P_1)5g[4]_{7/2}$<br>$(^1D_2)6p[3]_{7/2}-(^3P_1)5g[4]_{9/2}$ |
| 0 | 3264.03 | 30628.15 | 7.80 | $(^3P_2)6p[3]_{5/2}-(^3P_0)6d[2]_{3/2}$ |
| 0 | 3296.13 | 30329.90 | .49 | $(^3P_1)6p[2]_{3/2}-(^1D_2)6d[1]_{3/2}$ |
| 2 | 3516.71 | 28427.57 | .24 | $(^1D_2)5d[3]_{7/2}-(^3P_1)4f[4]_{7/2}$ |
| 2 | 3521.53 | 28388.66 | .42 | $(^3P_1)6p[2]_{5/2}-(^3P_2)5g[3]_{5/2}$ |
| 0 | 3539.41 | 28245.25 | 6.36 | $(^3P_1)6p[2]_{3/2}-(^3P_2)5g[3]_{5/2}$ |
| 2B | 3557.88 | 28098.63 | .64 | $(^1D_2)5d[3]_{7/2}-(^3P_1)4f[2]_{5/2}$ |
| 2B | 3589.02 | 27854.84 | 5.62 | $(^3P_1)5d[2]_{3/2}-(^3P_2)4f[3]_{5/2}$ |
| 1 | 3617.94 | 27632.18 | 1.45 | $(^3P_1)5d[2]_{5/2}-(^3P_2)4f[1]_{3/2}$ |
| 3<br>4 | 3645.29<br>3645.48 | 27424.87<br>27423.44 | 4.55 | $(^1D_2)6p[1]_{3/2}-(^3P_1)8s[1]_{3/2}$ |
| 0 | 3654.24 | 27537.70 | .07 | $(^3P_2)6p[1]_{3/2}-(^3P_0)6d[2]_{3/2}$ |
| 1 | 3665.47 | 27273.89 | 4.99 | $(^3P_1)6p[1]_{3/2}-(^3P_2)5g[2]_{3/2}$ |
| 1 | 3684.07 | 27136.19 | 5.39 | $(^3P_2)6p[2]_{5/2}-(^3P_2)6d[3]_{5/2}$ |
| 0B | 3731.00 | 26794.87 | .82 | $(^3P_1)5d[2]_{5/2}-(^3P_2)4f[2]_{3/2}$ |
| 0 | 3741.11 | 26722.38 | 1.14 | $(^1D_2)6s[2]_{3/2}-(^3P_2)7p[3]_{5/2}$ |
| 3A | 3745.46 | 26691.43 | 90.26 | $(^3P_1)6p[2]_{5/2}-(^1D_2)7s[2]_{3/2}$ |
| 0 | 3765.66 | 26548.25 | .20 | $(^3P_1)6p[2]_{3/2}-(^1D_2)7s[2]_{3/2}$ |

| | | | | | |
|---|---|---|---|---|---|
| 0 | 3773.83 | 26490.78 | .16 | $(^3P_1)5d[2]_{5/2}-(^3P_2)7p[1]_{3/2}$ | |
| 0 | 3810.67 | 26234.68 | 5.81 | $(^1D_2)5d[2]_{5/2}-(^3P_2)7p[2]_{3/2}$ | |
| 1A | 3883.35 | 25743.69 | .26 | $(^1D_2)5d[2]_{5/2}-(^3P_1)4f[3]_{5/2}$ | |
| 0 | 3962.15 | 25231.67 | .71 | $(^3P_1)6p[1]_{1/2}-(^1D_2)7s[2]_{3/2}$ | a |
| 1 | 4003.09 | 24973.66 | 2.65 | $(^3P_1)6p[2]_{5/2}-(^3P_1)6d[2]_{3/2}$ | |
| 0 | 4026.82 | 24826.50 | .02 | $(^3P_0)5d[2]_{3/2}-(^1D_2)6p[2]_{5/2}$ | |
| 0 | 4112.42 | 24309.71 | .78 | $(^3P_1)6p[2]_{3/2}-(^3P_2)8s[2]_{3/2}$ | |
| 0 | 4131.24 | 24199.01 | 98.00 | $(^3P_1)6p[2]_{5/2}-(^3P_2)8s[2]_{5/2}$ | |
| 0 | 4215.30 | 23716.46 | .98 | $(^3P_2)7s[2]_{5/2}-(^1D_2)4f[2]_{5/2}$ | |
| 3B | 4237.96 | 23589.65 | 8.75 | $(^3P_2)5d[3]_{5/2}-(^1D_2)6p[3]_{7/2}$ | |
| 1A | 4295.17 | 23275.40 | 4.93 | $(^3P_1)6p[1]_{3/2}-(^3P_2)8s[2]_{3/2}$ | |
| 2 | 4310.58 | 23192.24 | .14 | $(^3P_2)5d[3]_{5/2}-(^1D_2)6p[1]_{3/2}$ | b |
| 0 | 4357.28 | 22943.61 | 4.59 | $(^3P_2)7s[2]_{5/2}-(^1D_2)4f[1]_{3/2}$ | a |
| 0 | 4392.09 | 22761.76 | .23 | $(^3P_1)6s[1]_{1/2}-(^1D_2)6p[1]_{3/2}$ | a |
| 1 | 4404.54 | 22697.49 | .41 | $(^1D_2)6p[3]_{5/2}-(^3P_2)5g[2]_{5/2}$ | |
| 0 | 4427.53 | 22579.59 | .41 | $(^1D_2)6p[3]_{5/2}-(^3P_2)5g[4]_{7/2}$ | a |
| 0 | 4488.97 | 22270.56 | .35 | $(^3P_2)4f[4]_{9/2}-(^3P_1)5g[3]_{7/2}$ | a |
| 0A | 4508.97 | 22171.82 | .71 | $(^3P_2)4f[3]_{5/2}-(^3P_1)5g[4]_{7/2}$ | |
| 2B | 4550.91 | 21967.50 | .26 | $(^3P_0)6p[1]_{1/2}-(^3P_1)7s[1]_{3/2}$ | |
| 1 | 4591.80 | 21771.88 | 2.02 | $(^3P_1)6s[1]_{3/2}-(^3P_1)6p[1]_{1/2}$ | |
| 2 | 4591.94 | 21771.22 | | | |
| 5 | 4629.83 | 21593.04 | 2.24 | $(^3P_2)7p[3]_{5/2}-(^3P_1)5g[3]_{7/2}$ | |
| 5 | 4629.99 | 21592.29 | 2.09 | $(^3P_2)7p[3]_{5/2}-(^3P_1)5g[3]_{5/2}$ | |
| 4 | 4630.26 | 21591.00 | | | |
| 1H | 4673.94 | 21389.23 | 8.65 | $(^1D_2)6p[3]_{7/2}-(^3P_2)5g[4]_{9/2}$ | |
| 3 | 4675.42 | 21382.49 | .65 | $(^1D_2)6p[3]_{7/2}-(^3P_2)5g[4]_{7/2}$ | |
| 1H | 4681.65 | 21354.04 | .77 | $(^3P_2)4f[5]_{9/2}-(^3P_1)5g[5]_{9/2}$ | |
| | | | 3.82 | $(^3P_2)4f[5]_{9/2}-(^3P_1)5g[5]_{11/2}$ | |

| | | | | | |
|---|---|---|---|---|---|
| 0 | 4685.86 | 21334.83 | .59 | $(^3P_2)4f[5]_{9/2}-(^3P_1)5g[3]_{7/2}$ | a |
| 1B<br>4B | 4692.05<br>4692.15 | 21306.71<br>21306.22 | .93 | $(^3P_2)6d[4]_{9/2}-(^1D_2)4f[4]_{9/2}$ | |
| 4 | 4709.08 | 21229.62 | 8.41 | $(^3P_2)4f[4]_{7/2}-(^3P_1)5g[5]_{9/2}$ | |
| 0 | 4713.76 | 21208.55 | .23<br>.08 | $(^3P_2)4f[4]_{7/2}-(^3P_1)5g[3]_{7/2}$<br>$(^3P_2)4f[4]_{7/2}-(^3P_1)5g[3]_{5/2}$ | a |
| 3 | 4727.82 | 21145.51 | 4.30 | $(^3P_2)4f[2]_{5/2}-(^3P_2)5g[4]_{7/2}$ | |
| 1A | 4798.35 | 20834.66 | .82 | $(^3P_2)6d[4]_{7/2}-(^1D_2)4f[4]_{7/2}$ | |
| 2B | 4831.08 | 20693.55 | 4.36 | $(^3P_2)6d[3]_{7/2}-(^1D_2)4f[5]_{9/2}$ | |
| 1B | 4841.85 | 20647.52 | 8.40 | $(^1D_2)5d[3]_{5/2}-(^3P_2)7p[3]_{7/2}$ | |
| 3 | 4847.82 | 20622.10 | 3.22 | $(^3P_2)6d[4]_{7/2}-(^1D_2)4f[3]_{5/2}$ | |
| 0 | 4938.90 | 20241.79 | 40.29 | $(^3P_2)4f[5]_{9/2}-(^3P_2)7g[5]_{11/2}$ | |
| 0B | 5040.06 | 19835.52 | .54 | $(^3P_2)4f[5]_{11/2}-(^3P_0)5g[4]_{9/2}$ | |
| 0 | 5019.91 | 19915.09 | 6.28 | $(^3P_2)6d[2]_{5/2}-(^1D_2)4f[1]_{3/2}$ | a |
| 1 | 5570.91 | 17945.40 | .81 | $(^3P_2)4f[4]_{9/2}-(^3P_2)6g[6]_{11/2}$ | a |
| 0 | 5730.56 | 17445.45 | .92 | $(^3P_2)7p[3]_{5/2}-(^3P_1)8s[1]_{3/2}$ | |
| 0 | 5849.28 | 17091.35 | 90.90<br>.84 | $(^3P_2)4f[5]_{11/2}-(^3P_2)6g[5]_{11/2}$<br>$(^3P_2)4f[5]_{11/2}-(^3P_2)6g[5]_{9/2}$ | a |
| 4 | 5889.82 | 16973.75 | .33 | $(^3P_2)4f[5]_{9/2}-(^3P_2)6g[4]_{9/2}$ | a |
| 4 | 5891.70 | 16968.31 | 9.27 | $(^3P_2)4f[5]_{9/2}-(^3P_2)6g[5]_{11/2}$ | a |
| 2 | 6457.96 | 15480.51 | 79.29 | $(^3P_2)7p[2]_{5/2}-(^1D_2)6d[2]_{3/2}$ | |
| 0 | 6502.47 | 15374.52 | .31 | $(^3P_1)6p[0]_{1/2}-(^3P_2)6p[1]_{1/2}$ | |
| 0 | 6510.06 | 15356.59 | .62 | $(^3P_2)8s[2]_{3/2}-(^1D_2)6p[2]_{5/2}$ | |
| 0 | 6512.28 | 15351.38 | 50.98 | $(^3P_1)6p[1]_{3/2}-(^1S_0)5d[2]_{3/2}$ | |
| 0 | 6536.33 | 15294.88 | 3.45 | $(^3P_2)6p[1]_{1/2}-(^3P_2)6d[2]_{3/2}$ | |
| 3 | 6619.33 | 15103.11 | 2.78 | $(^1D_2)6p[2]_{5/2}-(^3P_2)8s[2]_{5/2}$ | |
| 0A | 6649.81 | 15033.87 | 5.27 | $(^3P_2)7s[2]_{3/2}-(^1S_0)6p[1]_{1/2}$ | |
| 0 | 6697.65 | 14926.49 | 5.29 | $(^3P_0)6p[1]_{3/2}-(^3P_2)6d[1]_{1/2}$ | |
| 0 | 6744.27 | 14823.30 | .23 | $(^1D_2)6p[1]_{1/2}-(^3P_2)8s[2]_{3/2}$ | a |

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