IONIC ASSIGNMENT OF Xe IV LINES

ASIGNACION IONICA DE LINEAS DEL Xe IV

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ABSTRACT

The Xe IV spectrum between 2280 and 6100 Å emitted by a new model of a non conventional spectroscopic source, has been studied. Six hundred and sixty seven lines has been assigned to this ion by employing the conventional method of energy variation, and the characteristic form of the spectral lines resulting from this type of spectral lamp has been particularly considered.

RESUMEN

El espectro del Xe IV entre 2280 y 6100 Å emitido por un nuevo modelo de fuente espectroscópica no–convencional, ha sido estudiado. Seiscientas sesenta y siete líneas han sido asignadas a este ion, empleando el método convencional de variación de energía, y ha sido particularmente considerada la forma característica de las líneas espectrales que resultan de este tipo de fuente espectral.

1. INTRODUCTION

The study of the thrice ionized Xe spectrum obtained from a non–conventional spectral source, has been reported in former papers (1–3).

A great quantity of lines with dubious assignment or without previous assignment, were there reported, representing a high percentage of the total of Xe IV lines studied.

In this paper we present the ionic assignment of six hundred and sixty seven lines, resulting from a new model of a non–conventional spectral source.

This assignment was first attained by varying the energy supplied to the source, and observing the behaviour in intensity of the lines, but it was mainly considered the fact that the shape of spectral lines is different for each ion, an effect which is remarked by the utilization of this new type of spectral source.

2. EXPERIMENTAL EQUIPMENT

The light source employed consisted of two Pyrex tubes ending in quartz windows, placed into a quartz tube, as shown in Fig. 1. The electrodes, 20 cm apart, were made of tungsten, and covered with indium.

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Gas pressure was of the order of 40 m Torr, and its excitation was accomplished by discharging through a triggered sparkgap a capacitor bank varying between 0.25 and 40 nF, and charged up to 15 kV.

Light radiation was axially analyzed, and focused by an achromatic lens onto the slit of an Ebert mounting 3.4 m focal distance spectrograph, equipped with a 600 lines/mm plane diffraction grating, blazed at 5000 Å.

Spectra were photographied at the first diffraction order with an approximate reciprocal dispersion of 5 Å/m.

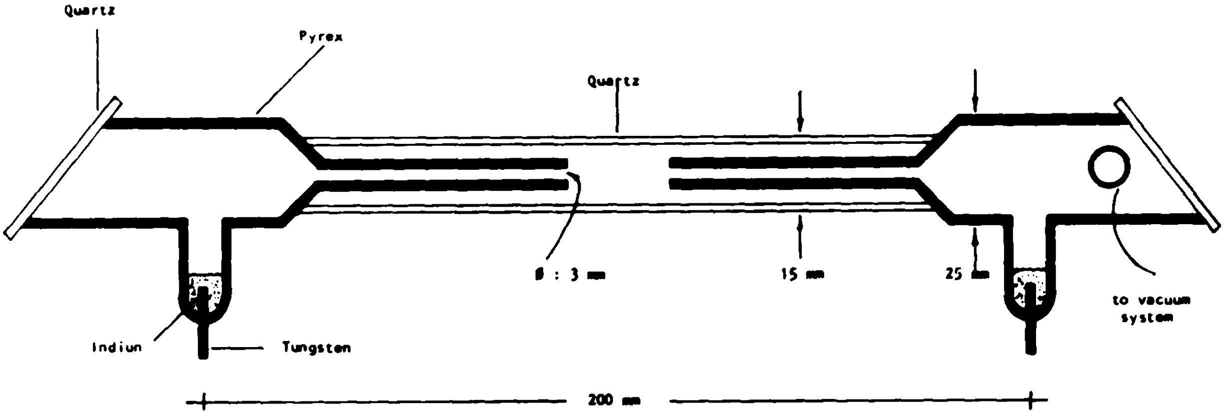

Fig. 1.— Scheme of the light source.

3. RESULTS

The great luminosity of the new spectral source, and the employment of a simple device for focusing the light onto the spectrograph slit, permitted to record a spectrum rich in lines, and to obtain on the photographic plate a clear image of the spatial distribution of ionized plasma when viewing from the front, through the window.

Observing such lines in the exposition of greater energy, it results that those having a spindle shape correspond to Xe IV; those having a normal shape, to Xe III; and those showing less intensity at the middle of the line, correspond to Xe II. All this is due to the fact that the greater current density is concentrated at the center of the tube.

In this way, as shown in Fig. 2, already the shape of the spectral line gives a first idea about the ionic species to which it belongs, later confirmed by energy variation.

This last way of discerning the assignment of each line in previous works, left some doubts that have been partially cleared in this paper.

In Table I it is shown a list of lines assigned to the Xe IV spectrum.

The first and second columns list the wavelength in Ångstrom, and the wave number in cm^{-1}, respectively. The relative intensity in a range of 0 to 5, is given in the third column.

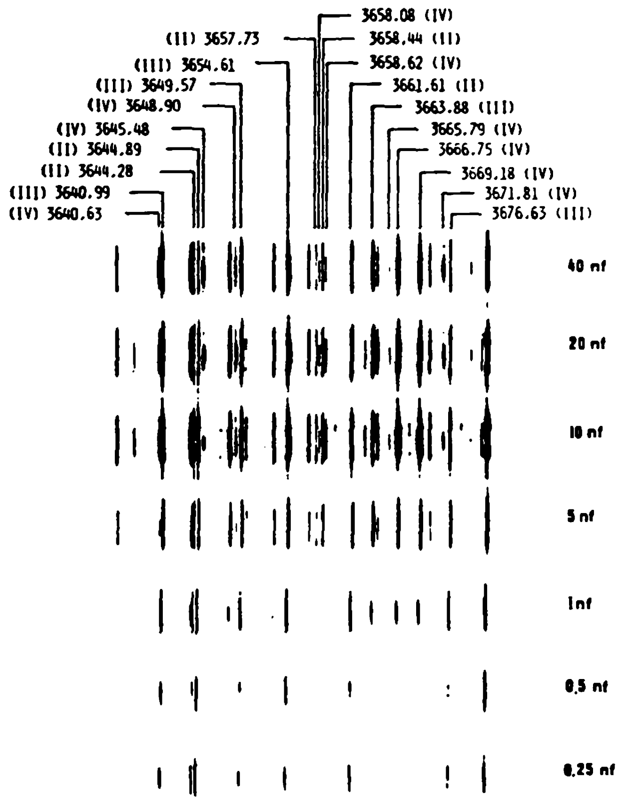

Fig. 2.— Spectrograms obtained at 5 kV varying the circuit capacitance. The difference in line forms are mainly observed in spectra photographied with greater energy.

TABLE I: Lines assigned to Xe IV in the region 2280-6100 Å

Symbols in column four: a=without previous assignment; b=revised assignation, and c=new lines (Δλ= ± 0.06 Å).

Wave-length Å	Wave-number cm^{-1}	In-ten-sity	Com-ment	Wave-length Å	Wave-number cm^{-1}	In-ten-sity	Com-ment
2284.76	43754.81	1	a	2372.47	42137.34	1	a
2287.13	43709.40	0	a	2372.86	42130.41	0	a
2288.90	43675.68	0	a	2374.15	42107.52	0	a
2289.46	43665.00	0	a	2375.12	42090.33	1	a
2289.96	43655.47	0	a	2376.45	42066.77	0	a
2293.21	43593.60	0	a	2378.26	42034.76	0	a
2296.17	43537.41	0	a	2381.96	41969.47	0	a
2297.98	43503.12	2	a	2385.27	41911.24	2	a
2303.54	43398.12	0	c	2393.88	41760.51	1	a
2304.12	43387.21	1	a	2394.31	41753.01	0	a
2305.56	43360.11	0	a	2394.45	41750.57	0	a
2306.59	43340.75	0	a	2400.50	41645.35	1	a
2308.60	43303.02	0	a	2402.41	41612.24	0	a
2311.04	43257.30	0	a	2407.63	41522.03	0	a
2311.46	43249.44	1	a	2408.30	41510.48	1	a
2314.40	43194.51	0	a	2408.41	41508.58	1	a
2315.56	43172.87	0	a	2409.59	41488.26	3	a
2316.27	43159.64	1	b	2411.08	41462.62	0	a
2317.12	43143.81	0	a	2412.87	41431.87	1	a
2318.04	43126.69	1	a	2413.44	41422.08	1	a
2320.60	43079.11	0	a	2413.84	41415.22	2	b
2323.10	43032.76	0	a	2415.61	41384.87	2	a
2327.05	42959.72	1	a	2420.81	41295.98	1	b
2327.26	42955.84	1	a	2428.97	41157.26	4	a
2331.40	42879.57	0	a	2431.07	41121.71	2	a
2338.29	42753.23	1	a	2432.35	41100.07	1	a
2338.58	42747.93	1	a	2433.59	41079.13	3	a
2340.92	42705.20	2	a	2435.82	41041.53	0	a
2343.54	42657.47	2	a	2436.78	41025.36	0	a
2344.99	42631.09	1	a	2438.08	41003.49	0	a
2345.28	42625.82	2	a	2441.49	40946.22	4	a
2346.86	42597.12	1	a	2441.86	40940.02	3	a
2348.02	42576.08	0	a	2443.37	40914.72	3	a
2351.44	42514.16	1	a	2445.51	40878.92	2	b
2351.58	42511.63	0	b	2446.08	40869.39	1	a
2355.70	42437.28	0	a	2447.64	40843.35	2	b
2360.20	42356.38	0	a	2449.04	40820.00	1	a
2360.85	42344.72	0	a	2450.90	40789.02	1	a
2364.13	42285.98	0	b	2451.37	40781.20	1	a
2371.89	42147.64	0	a	2455.05	40720.08	3	a

Wave-number cm^{-1}	In-ten-sity	Com-ment	Wave-length Å	Wave-number cm^{-1}	In-ten-sity	Com-ment
40707.15	1	a	2543.95	39297.19	0	a
40642.28	0	a	2544.95	39281.75	0	a
40594.26	0	a	2549.45	39212.41	1	a
40543.39	0	a	2552.18	39170.47	5	a
40461.52	1	a	2552.92	39159.12	0	a
40422.74	3	a	2557.59	39087.62	1	a
40411.96	1	a	2558.90	39067.61	1	a
40394.81	1	a	2559.29	39061.66	3	a
40353.73	1	a	2562.04	39019.74	0	a
40305.57	1	a	2564.13	38987.93	2	a
40276.51	2	a	2564.92	38975.92	1	a
40222.71	2	a	2569.38	38908.27	2	a
40213.81	0	a	2571.43	38877.26	0	a
40138.90	2	a	2573.36	38848.10	1	a
40107.34	1	a	2573.59	38844.63	1	a
40099.45	2	a	2578.89	38764.80	0	b
40035.71	1	a	2579.46	38756.24	1	a
40019.04	2	a	2584.11	38686.50	2	a
40004.15	1	a	2587.59	38634.48	0	a
39995.18	1	a	2595.97	38509.77	1	a
39944.37	1	a	2596.23	38505.92	0	a
39925.23	1	a	2597.25	38490.79	0	a
39902.92	0	a	2599.62	38455.70	1	a
39888.11	0	a	2603.52	38398.10	1	a
39854.08	2	a	2604.29	38386.75	1	a
39754.40	2	a	2609.82	38305.42	0	a
39722.18	2	a	2622.74	38116.73	0	a
39716.19	1	b	2626.98	38055.21	1	a
39668.44	2	a	2631.14	37995.05	1	a
39638.56	0	a	2633.39	37962.58	1	a
39604.01	1	a	2642.38	37833.44	0	a
39593.34	0	a	2643.89	37811.83	1	a
39584.10	1	a	2664.68	37516.83	1	b
39566.55	2	a	2691.74	37139.70	4	b
39531.66	0	a	2703.27	36981.30	2	a
39520.41	0	a	2706.08	36942.90	0	a
39448.68	1	a	2710.13	36887.70	1	b
39429.07	1	a	2712.57	36854.52	0	a
39380.00	2	a	2715.59	36813.54	1	b
39338.63	0	a	2716.43	36802.15	1	b

TABLE I (continued)

Wave-number cm^{-1}	In-tensity	Com-ment	Wave-length Å	Wave-number cm^{-1}	In-tensity	Com-ment
36627.82	1	a	2936.86	34040.05	1	b
36595.64	1	a	2946.36	33930.30	2	b
36575.69	0	a	2955.40	33826.52	2	a
36518.78	0	a	2958.84	33787.19	1	a
36438.38	1	b	2959.69	33777.49	1	a
36332.05	1	a	2967.12	33692.91	2	b
36261.94	0	a	2971.53	33642.91	2	a
36260.10	0	a	2971.72	33640.76	1	a
36256.29	1	a	2971.95	33638.15	0	a
36223.05	0	a	2973.21	33623.90	0	a
36203.51	1	b	2974.41	33610.33	0	a
36191.71	0	a	2975.21	33601.30	0	a
36150.88	1	a	2977.26	35578.16	0	a
36129.20	1	a	2987.66	33461.28	1	a
36051.42	0	a	2996.94	33357.67	0	b
35993.79	1	a	2998.94	33335.43	2	b
35959.35	1	a	3001.25	33309.77	0	a
35935.83	0	b	3005.94	33257.80	0	a
35875.22	0	b	3007.02	33245.86	0	a
35802.89	2	a	3013.17	33178.01	0	b
35793.66	0	a	3016.43	33142.15	1	a
35728.93	1	a	3017.02	33135.67	1	a
35721.91	1	a	3018.81	33116.02	0	a
35629.61	1	a	3020.52	33097.27	1	a
35550.68	0	a	3021.77	33083.58	1	a
35531.22	1	a	3022.34	33077.34	1	b
35410.29	1	a	3031.85	32973.59	0	a
35339.56	0	a	3046.75	32812.34	0	c
35309.11	1	a	3047.56	32803.62	0	b
35193.02	0	a	3055.00	32723.74	1	b
35154.33	1	a	3055.50	32718.38	1	a
34921.71	1	a	3060.94	32660.24	0	a
34904.16	2	b	3063.43	32633.69	2	a
34865.81	1	b	3064.73	32619.85	0	a
34796.64	1	a	3065.56	32611.02	0	b
34701.71	0	a	3074.48	32516.41	0	b
34486.13	0	a	3076.00	32500.34	0	c
34379.39	0	a	3076.16	32498.65	0	b
34312.49	0	a	3076.79	32491.99	0	c
34147.25	2	a	3094.34	32307.72	0	a

TABLE I (continued)

Wave-number cm^{-1}	In-ten-sity	Com-ment	Wave-length Å	Wave-number cm^{-1}	In-ten-sity	Com-ment
32272.78	1	b	3265.81	30611.48	0	c
32255.81	0	a	3267.19	30598.55	1	a
32076.05	1	a	3270.57	30566.93	2	b
32066.59	1	a	3270.85	30564.31	1	a
32058.26	1	b	3272.09	30552.73	0	a
31946.39	1	a	3273.74	30537.33	3	b
31911.11	2	b	3275.73	30518.78	1	a
31891.56	3	b	3276.07	30515.61	0	a
31804.72	0	c	3277.07	30506.30	0	a
31786.22	0	c	3277.55	30501.83	2	a
31694.81	0	a	3281.82	30462.15	2	a
31647.66	0	b	3284.46	30437.66	2	a
31513.39	0	a	3286.53	30418.50	0	c
31473.40	0	a	3289.27	30393.16	1	a
31469.84	0	c	3294.04	30349.15	0	a
31458.55	1	a	3295.06	30339.75	1	b
31444.70	3	b	3295.76	30333.31	0	a
31361.25	1	a	3299.39	30299.94	1	a
31330.68	1	a	3307.09	30229.39	0	a
31307.43	2	b	3312.33	30181.57	3	a
31295.37	1	a	3315.75	30150.44	1	a
31209.60	1	a	3322.57	30088.56	1	a
31186.43	0	c	3326.74	30050.84	0	c
31112.57	1	a	3327.24	30046.32	0	a
31092.34	0	a	3330.84	30013.85	5	b
31069.74	1	a	3334.17	29983.88	2	b
31067.13	0	a	3336.96	29958.81	0	c
31049.66	0	a	3340.76	29924.73	3	b
31010.18	0	a	3341.87	29914.80	0	c
30919.45	2	b	3342.83	29906.20	0	a
30918.21	1	b	3343.49	29900.30	1	a
30746.39	1	a	3344.71	29889.39	1	a
30740.62	0	c	3351.47	29829.11	0	a
30736.18	1	a	3355.96	29789.20	2	b
30718.14	0	a	3377.15	29602.29	3	a
30698.80	1	b	3381.25	29566.40	1	b
30693.62	0	a	3397.05	29428.89	1	a
30666.22	2	a	3397.48	29425.16	1	b
30657.95	5	a	3398.61	29415.38	1	a
30615.98	5	a	3402.32	29383.31	0	a