PAPERS NOT PRESENTED AT THE MEETING

XUV SPECTRA OF Ag XVII - Ag XXI AND Cd XVIII - Cd XXII FROM LASER PRODUCED PLASMAS

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The spectra of highly ionized Ag and Cd in the region 20-200 A° excited in laser produced plasmas were recorded and analyzed. The spectral lines identified correspond to Ag XVII - Ag XXI and Cd XVIII - Cd XXII involving transitions of the type $3d^k\ nl - 3d^k\ nl'$ and $3d^k - 3d^{k-1}\ nl''$ where k = 9,10; n = 4,5,6; l = s,p,d,f; l' = s,p,d,f,g, and l'' = p,f.

The experimental work was carried out at the Australian National University Research School of Physical Sciences. The Nd=glass laser system delivered pulsed powers of the order of 10^{15}W/cm^2 onto flat metalic targets placed in a vacuum. The target could be positioned accurately in the focal plane of the input lens. The spectra were recorded photographically on Kodak SC5 plates with a 2-m grazing incidence spectrograph (Hilger & Watts E-580) employing a 600 lines/mm grating at 88.157° incidence. A maximum of three laser pulses gave the desired plate exposure while a single shot exposure from a pure carbon target plasma provided the reference points for wavelength calibration. The well-known Lyman spectra of CV1 and CV appeared strong and could be clearly identified upto their 5th order. The wavelengths of some strong lines of Ag XIX and Cd XX previously measured (1) were used as secondary wavelength standards and a best fit was then made with the wavelengths computed from the dispersion equation of the grating. The accuracy of the measured wavelengths was within 0.02A° and better than 0.005A° at points closer to the reference lines.

The line classifications are based on simple extrapolations along isoelectronic sequences as well as on comparisions with the calculated transition energies (2) computed from electron orbital binding energies for different configurations by a multiconfigurational relativistic Dirac-Fock computer code developed originally by Desclaux (3). A point nucleus was assumed for the calculations. The effect of the finite size of the nucleus has been investigated to be neglegibly small (4). In Table-I we compare some of our computed and measured wavelengths with previously published data (1,5,6).

A number of principal transitions of ions isoelectronic with copper 1 have been reported in several papers (1,7,8). We have observed all those transitions, and in addition we report here (Table-II) the following new transitions: 4s-6p; 4p-6s, 6d, 7d; 4d-6p, 7f; 5s-6p; and 5p-6s, 6d of Ag XIX and Cd XX which have not been observed so far. We have also observed $3d^{10}4s$-$3d^{9}4s4p$ and $3d^{10}4s$-$3d^{9}4p^{2}$ transitions in the region 29 - 33 A°.

The 3d-4p, 5p and 3d-4f,5f transitions of Ag XX were reported by Schweitzer et al (9) while Wyart et al (10) reported $3d^{9}$-$3d^{8}$ 4p transitions of Ag XXI. We have identified the principal transitions of the ions Ag XVII - Ag XX1 and Cd XVIII - Cd XXII involving energy levels with n=4,5,6,7 where n is the principal quantum number. A comprehensive listing of these transitions will appear in a separate publication (11).

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Table - I

Sample Comparison of our Calculated/Measured Wavelengths with thosepreviously Calcualted/Measured

Ion	Transition	Calculated Wavelength(A^{o})		Observed Wavelength (A^{o})	
		Present	Previous	Present	Previous
AgXIX	4s $^{2}S_{\frac{1}{2}}$ – 5p $^{2}P_{3/2}$	52.46	52.98 (a)	52.37	52.37 (b)
	4s $^{2}S_{\frac{1}{2}}$ – 5p $^{2}P_{3/2}$	53.15	53.85 (a)	53.14	53.16 (b)
Cd XX	4d $^{2}D_{3/2}$ – 5f $^{2}F_{5/2}$	61.73	61.97 (c)	61.75	61.73 (b)
	4d $^{2}D_{5/2}$ – 5f $^{2}F_{7/2}$	62.13	62.46 (c)	62.25	62.23 (b)
	4s $^{2}S_{1/2}$ – 5p $^{2}P_{3/2}$	48.43	48.46 (c)	48.35	48.35 (b)
	4s $^{2}S_{1/2}$ – 5p $^{2}P_{1/2}$	49.12	49.23 (c)	49.12	49.12 (b)

(a) Reference (6)

(b) Reference (1)

(c) Reference (5)

Table II

Classifications of Spectral Lines in the XUV Spectra of Ag XIX and CdXX

Transition	J-J	Ag XIX		Cd XX	
		λ_{obs} (A^o)	$\lambda_{calc.}$ (A^o)	λ_{obs} (A^o)	$\lambda_{calc.}$ (A^o)
$3d^{10}\ 4s(^2S)-3d^{10}6p(^2P)$	$\frac{1}{2}-\frac{3}{2}$	37.85	37.82	—	34.84
$4s - 6p$	$\frac{1}{2}-\frac{1}{2}$	38.1	38.01	—	35.02
$3d^{10}4p(^2P)-3d^{10}7d(^2D)$	$\frac{1}{2}-\frac{3}{2}$	35.32	35.50	32.58	32.56
$3d^{10}4p(^2P)-3d^{10}6d(^2D)$	$\frac{1}{2}-\frac{3}{2}$	40.83	40.76	37.62	37.45
$3d^{10}4p(^2P)-3d^{10}6s(^2S)$	$\frac{1}{2}-\frac{1}{2}$	44.69	44.64	40.98	40.91
$3d^{10}4d(^2D)-3d^{10}7f(^2F)$	$\frac{5}{2}-\frac{7}{2}$ $\frac{5}{2}-\frac{5}{2}$	43.17	43.28	39.52	39.48
$4d - 7f$	$\frac{3}{2}-\frac{5}{2}$	42.88	43.12	39.30	39.33
$3d^{10}4d(^2D)-3d^{10}6p(^2P)$	$\frac{3}{2}-\frac{3}{2}$	56.57	56.98	51.59	51.79
$3d^{10}5s(^2S)-3d^{10}6p(^2P)$	$\frac{1}{2}-\frac{3}{2}$	111.15	110.59	102.29	101.60
$5s - 6p$	$\frac{1}{2}-\frac{1}{2}$	112.7	112.19	103.66	103.18
$3d^{10}5p(^2P)-3d^{10}6s(^2S)$	$\frac{3}{2}-\frac{1}{2}$	154.12	154.12	141.05	140.84
$5p - 6s$	$\frac{1}{2}-\frac{1}{2}$	148.46	148.41	135.59	135.33
$3d^{10}5p(^2P)-3d^{10}6d(^2D)$	$\frac{3}{2}-\frac{5}{2}$	115.80	115.76	106.75	106.46
$5p - 6d$	$\frac{3}{2}-\frac{3}{2}$	116.20	116.10	107.17	106.81