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**Theoretical and Physical Chemistry Institute  
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*48, Vas. Constantinou Ave.,  
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# ENERGY LOSS SPECTROSCOPY OF CADMIUM AUTOIONIZING LEVELS

B. Marinković, V. Pejčev and D.M. Filipović  
*Institute of Physics, P.O.Box 57, 11001 Belgrade, Serbia, Yugoslavia*

Detailed structure and properties of autoionizing spectrum of cadmium is extensively studied both experimentally and theoretically. Photoabsorption spectroscopy revealed long Rydberg series of autoionizing resonances corresponding to the excitation of one electron from 4d subshell [1]. By high resolution ejected electron spectroscopy [2], autoionizing levels following two-electron excitation were examined. Also coherent excitation of  $J=0,1,2$  autoionizing levels have been measured by  $(e,2e)$  spectroscopy [3]. The energies and identification of cadmium autoionizing spectra have been comprehensively reviewed by Mansfield and Murrane [4] by applying extensive multiconfigurational calculations. Martin [5] re-analysed  $4d^95s^25p$   $J=1$  photoabsorption spectra using a theory of overlapping resonances while Cowan and Wilson [6] provide *ab initio* estimates of discrete-continuum electrostatic interaction widths for all levels of the  $4d^95s^25p$  configuration decaying into the  $4d^{10}5s\epsilon p$  and  $4d^{10}5s\epsilon f$  continua.

Here, we present the first high resolution energy-loss spectrum of cadmium autoionizing levels from the first ionization level (8.994 eV) up to 18 eV. Spectra were obtained at 18, 20, 25, 40 and 60 eV impact energy with 40 meV energy resolution. Differential cross sections for the  $(4d^95s^25p)$   $^3P_1$  and  $^1P_1$  levels were measured at 40 eV from  $2^\circ$  to  $150^\circ$  scattering angles [7].

Series of states originated from simultaneous excitation of two 5s electrons are detected. The low lying levels are of configuration  $(4d^{10}5p^2)$   $^3P$ ,  $J=1$  and  $J=2$  at 9.240 eV and 9.393 eV respectively. Corresponding ejected electron energies are 0.246 and 0.399 eV respectively. These states have not been observed in ejected-electron spectra [2] as they were recorded from 0.7 eV of ejected electrons. Calculated energies [4] for these states are 9.267 and 9.386 eV respectively. At 10.051 eV we also observed broad state of 0.68 eV width, which we assigned as  $(4d^{10}5p^2)$   $^1D_2$  state. From the series of the 12  $(4d^95s^25p)$  states we were able to detect  $^3P_1$  at 12.065 eV,  $^1P_1$  at 12.810 eV and  $^3D_1$  at 12.943 eV.

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## References:

- [1] Baig M A, Akram M, Bhatti S A, Sommer K and Hormes J, *J.Phys.B:At.Mol.Opt.Phys.* **27** (1994) 1693-708
- [2] Pejčev V, Rassi D and Ross K J, *J.Phys.B:At.Mol.Phys.* **10** (1977) L629-33
- [3] Martin N L S and Thompson D B, *Phys.Rev.A* **43** (1991) 2281-8
- [4] Mansfield M W D and Murrane M M, *J.Phys.B:At.Mol.Phys.* **18** (1985) 4223-44
- [5] Martin N L S, *J.Phys.B:At.Mol.Opt.Phys.* **23** (1990) 2223-31
- [6] Cowan R D and Wilson M, *J.Phys.B:At.Mol.Opt.Phys.* **24** (1991) 111-4
- [7] Marinković B, Pejčev V and Filipović D, *Proc.XVIII ICPEAC*, Aarhus, Denmark, 1993 p.176