

Received by OSTI

JAN 30 1991

ELECTRON COLLISIONAL EXCITATION OF K- AND B-LIKE IONS

DOE/ER/53293--2

DE91 006900

PROGRESS REPORT

Alfred Z. Msezane
Department of Physics
Atlanta, Georgia 30314

June 30, 1990

Submitted to U. S. DOE,
OFFICE OF FUSION ENERGY

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED
42

PROGRESS REPORT

During the period covered by this report, 9/1/89 - 6/30/90, the following were accomplished:

(1) Collision cross sections for Cr^{5+} between the ground state and the excited states $4s\ 2S$, $4p\ 2P^o$, $4d\ 2D$, $3p^5 3d^2(1S, 1D)\ 2P^o$, $3p^5 3d^2(1D\ 2D^o)$ and $3p^5 3d^2(1G, 1D)\ 2F^o$ were calculated¹ using a 9-state R-matrix method² for the energy range from near threshold to about 20Ry. The results were contrasted with those from NIEM³ 5CC and DW.⁴ Significant differences among the 9CC, 5CC and DW results were noted for $4s\ 2S$, $4p\ 2P^o$ and $4d\ 2D$, even away from the resonance energy region, which we attributed to the importance of coupling. For the elastic and the $4f\ 2F^o$ cross sections, the 9CC and 5CC and the 5CC and 2CC results, respectively are in good agreement. Measurement is necessary to determine the magnitudes of the various cross sections we calculated.

(2) Using our elaborate N^{2+} target wave function, we performed⁵ a 10-state R-matrix calculation for excitation cross sections from ground state to the doublet states arising from the $2s2p^2$ and $2s^2 3l\ (l = 0, 1\ \text{and}\ 2)$ configurations and to the $2s^2 p^4\ 4P$ state for $1.6 \leq E \leq 15\text{Ry}$. Distorted wave cross sections were also computed and compared with the CC results. For some transitions, DW results differ from the CC ones by as much as a factor of 2.5. We interpret the large discrepancy between DW and CC as a manifestation of strong coupling effects for the $e\text{-N}^{2+}$ system. It is expected that the effects will even be more significant for both the atom and the singly ionized ion.

(3) Historically, we have used the NMFEEC computing facilities through support from Oak Ridge National Laboratory, without which we could not carry out competitive research. Consequently, we acknowledged support for the electron excitation calculations of the core-excited Na I quartet states⁶ and photoionization of Na. Both calculations required extensive but different target wave functions. We have included copies of the submitted manuscripts / page

proof showing the acknowledgements. Initially, large amounts of computer times are required for generation of extensive C.I. target wave functions.

REFERENCES

1. A. Z. Msezane, W. Richards and R. J. W. Henry, Phys. Rev. A, submitted (1990).
2. K. A. Berrington, P. G. Burke, W. D. Robb, M. Le Dourneuf, K. T. Taylor and Vo Ky Lan, Comput. Phys. Commun. 14, 367 (1978).
3. R. J. W. Henry, S. P. Rountree and E. R. Smith, Comput. Phys. Commun. 23, 233 (1981).
4. M. S. Pindzola, D. C. Griffin and C. Bottcher, Phys. Rev. A 39, 2385 (1989).
5. A. Z. Msezane, K. J. Reed and R. E. H. Clark, Phys. Rev. A submitted (1990).
6. A.Z. Msezane and P. Awuah, J. Phys. B (submitted, revised) (1990).

PRESENTATIONS

1. "Excitation Cross Sections for K-Like Cr by Electron Impact," W. Richards, J. Lee, W. Armstrong-Mensah, A. Z. Msezane and R. J. W. Henry, Abstracts, XIV ICPEAC, 362 (1989).
2. "Electron Collision Cross Sections for Boron-Like Nitrogen," A. Z. Msezane, R. E. Clark and K. J. Reed , Abstracts, XIV ICPEAC, 363 (1989).
3. "Cross Sections for Some Core-Excited Na I Quartet States" Proc. GEC 89, Program and Abstracts, Palo Alto (1989).

END

DATE FILMED

02 / 12 / 91

