SYMPOSIUM ON THE PHYSICS OF IONIZED GASES

1982

Contributed Papers

Dubrovnik, Aug. 23—Aug. 27

Institute of Physics
of the University
Zagreb, Yugoslavia

ANGULAR DISTRIBUTION OF ELECTRONS SCATTERED BY ARGON ATOM*

D. Filipović, V. Pejčev, B. Marinković and L. Vušković
Institute of Physics, P.O.Box 57, 11001 Beograd, Yugoslavia

Electron impact scattering by rare-gas atoms have been of great interest since 1930's. But only recently differential cross section investigations of argon atom approached the whole intermediate energy region. Elastic scattering of Srivastava et al.[1] summarizes earlier results; data by Chutjian and Cartwright[2] include 23 electronic state excitation cross sections. The lowest four excited states have been theoretically treated by Padial et al.[3]

We studied argon atom using a crossed electron beam-gas scattering technique. For these measurements an electron impact spectrometer has been used. Since our apparatus has not been described in the literature so far, some of its performances will be given here. The vacuum chamber has a double μ-metal shield, and residual magnetic field is less than 10^{-7} T. With oil diffusion pumps the background pressure is about 2×10^{-5} m barr. The monochromator and analyzer have 180° spherical condensor selector and cylindrical dispersion elements described by Chutjian[4], both differentially pumped. The primary beam current is of the order of 10^{-9} A. The overall energy resolution is about 40 meV. The scattering angle (θ) can be changed from -30° to 150°. The electron scattering intensities as a function of energy loss (ΔE) at fixed impact energies (E_o) and fixed scattering angles were measured by multichannel scaling techniques.

With the impact energy of 20 and 80 eV we measured the angular distribution of inelastic processes in energy loss range from 11.5 eV to 13.6 eV. Typical energy loss spectra is shown in Fig. 1. The first five and the last peak in the figure belong to excitation of only one state and we looked for their angular dis-

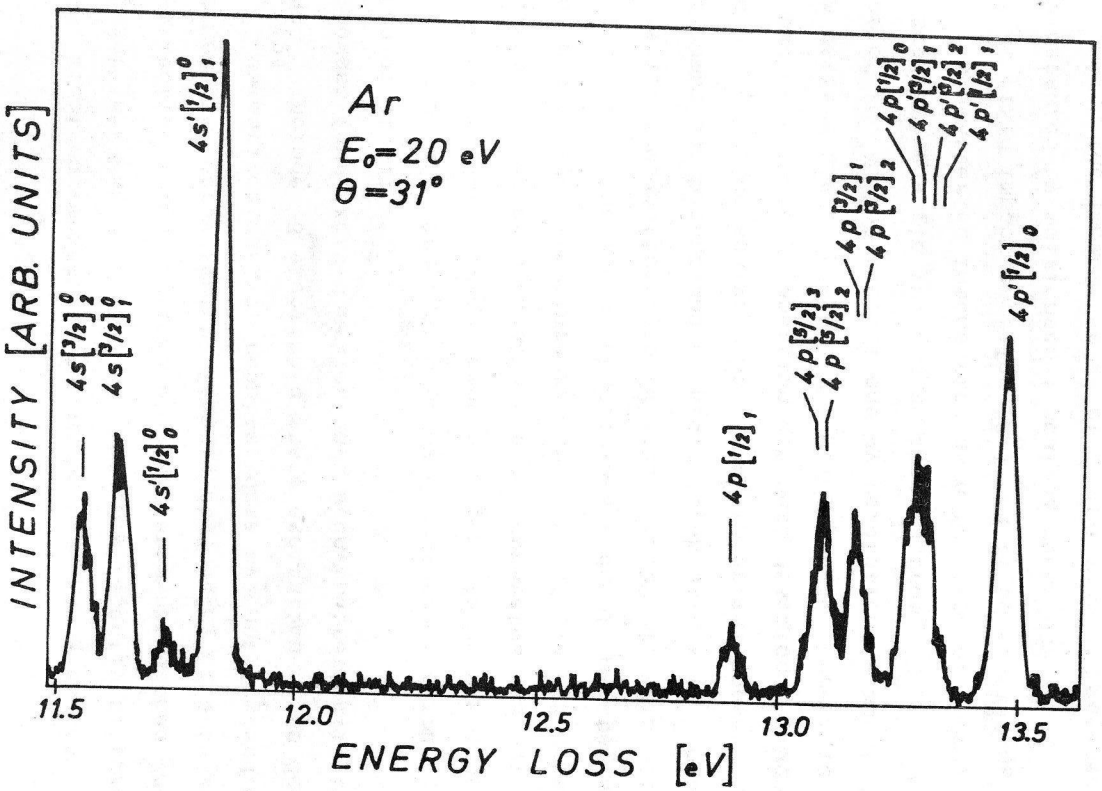
Ar
E_0=20 eV
θ=31°
INTENSITY [ARB. UNITS]
ENERGY LOSS [eV]
11.5
12.0
12.5
13.0
13.5
4s[3/2]$^0_2$
4s[3/2]$^0_1$
4s'[1/2]$^0_0$
4s'[1/2]$^0_1$
4p[1/2]$_1$
4p[5/2]$_3$
4p[5/2]$_2$
4p[3/2]$_1$
4p[3/2]$_2$
4p[1/2]$_0$
4p[5/2]$_2$
4p'[3/2]$_1$
4p'[1/2]$_1$
4p'[1/2]$_0$

Figure 1.

tributions. Other peaks containing many transitions will be analyzed later on. We measured the angular distribution for excitation of the $4s'[1/2]^{o}_{1}$ state (the fourth in the figure) separately and normalized to the absolute cross section scale using a theoretical value of Padial et al.[3] at 60^{o}. At this angle the influence of the geometrical correction is negligible and the experimental value of Chutjian and Cartwright[2] is very close, too. Relative intensities of differential scattering for excitation of states $4s[3/2]^{o}_{2}$, $4s[3/2]^{o}_{1}$, $4s'[1/2]^{o}_{o}$ $4p[1/2]_{1}$ and $4p'[1/2]_{o}$ were normalized with respect to the $4s'[1/2]^{o}_{1}$ transition.

In addition to this we have also measured the angular distribution of elastically scattered electrons and obtained a good agreement with other available data.[1]

REFERENCES

1. S.K. Srivastava, H. Tanaka, A. Chutjian and S. Trajmar, Phys. Rev. A, 23 (1981) 2156
2. A. Chutjian and D.C. Cartwright, Phys. Rev. A, 23 (1981) 2178
3. N.T. Padial, G.D. Meneses, F.J. da Piaxao, Gy. Csanak and D.C. Cartwright, Phys. Rev. A, 23 (1981) 2194
4. A. Chutjian, Chem. Phys. 61 (1974) 4279

*Supported by RZN SRS Yugoslavia and partly by NBS (G) 260, USA.