EXCITATION OF K* ($3p^5 4s^2\,^2P_{3/2}$, $^2P_{1/2}$) BY ELECTRON IMPACT: ALIGNMENT AND CROSS SECTION RATIOS

B. Matterstock, R. Huster, B. Paripas*, A.N. Grum-Grzhimailo#, W. Mehlhorn

Fakultät für Physik, Universität Freiburg, D-79104 Freiburg, Germany
*Department of Physics, University of Miskolc, H-3515, Miskolc-Egyetemvaros, Hungary
#Institute of Nuclear Physics, Moscow State University, 119899 Moscow, Russia

We have measured the alignment A_{20} of $K^*(3p^5 4s^2\,^2P_{3/2})$ and the ratio of cross sections $R_0 = \sigma(3/2)/\sigma(1/2)$ of the fine structure states $K^*(3p^5 4s^2\,^2P_{3/2}, {}^2P_{1/2})$ for electron impact excitation in the range of incident energy E_0 = 31.4 eV - 500 eV[1]. The alignment A_{20} was measured via the anisotropic angular distribution of autoionization electrons

$$I_{3/2}(\vartheta) = I_{3/2}\{1 + A_{20}(E_0)\alpha_2 P_2(\cos\vartheta)\},$$

where α_2 is the decay parameter (with the value -1) and $P_2(\cos\vartheta)$ is the second Legendre polynomial. The ratio of cross sections $R_0 = \sigma(3/2)/\sigma(1/2)$ were measured as ratio of line intensities $I_{3/2}/I_{1/2}$ of autoionization electrons at the magic angle ϑ_m=54,7. The results for A_{20} are plotted in Fig. 1 as function of impact energy E_0.
We have also calculated the quantities A_{20} and R_0 in the plane wave Born approximation (PWBA) and distorted wave Born approximation (DWBA). For A_{20} best agreement with experiment is achieved if the exchange distortion potential V_{ex} and the exchange amplitude T_{ex} are included in the DWBA calculation (curves 5,6,7 in Fig. 1). The DWBA values of Pangatiwar and Srivastava[2] do not agree with the experimental values for E_0 < 100 eV.

This work is part of the Sonderforschungsbereich 276 "Correlated dynamics of highly excited atomic and molecular systems" at the Universität Freiburg and is supported by the Deutsche Forschungsgemeinschaft.

1. B. Matterstock, R. Huster, B. Paripas, A.N. Grum-Grzhimailo, W. Mehlhorn // J. Phys. B 1995, v. 28, in print
2. A.W. Pangantiwar, R. Srivastava // J. Phys. B 1987, vol. 20, 5881

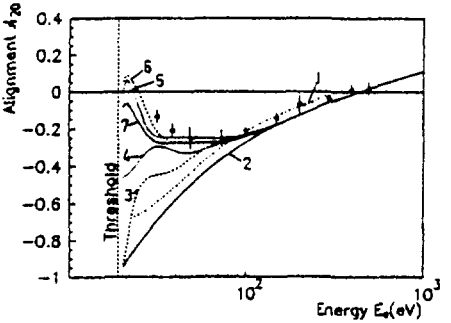

Fig. 1. Alignment A_{20} of K^* ($3p^5\,4s^2\,^2P_{3/2}$) as function of electron impact energy E_0. Present experiment = ●. Theory: curve 1 = DWBA[2], curves 2 to 7 = present calculations. (2) = PWBA; (3) = DWBA, $V_{opt} = V_{st}$, ground-state electron density, $T = T_{dir}$; (4) = DWBA, $V_{opt} = V_{st}$, ground-state electron density, $T = T_{dir} - T_{ex}$; (5) = DWBA, $V_{opt} = V_{st} + V_{ex}$, ground state electron density, $T = T_{dir}$; (6) = DWBA, $V_{opt} = V_{st} + V_{ex}$, ground-state electron density, $T = T_{dir} - T_{ex}$; (7) = DWBA, $V_{opt} = V_{st} + V_{ex}$, excited-state electron density, $T = T_{dir} - T_{ex}$.