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# Laser Induced Fluorescence Spectroscopy of Excited Neon Atoms in a Liquid-nitrogen-temperature Glow Discharge Plasma under a Strong Magnetic Field

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The analysis of inter- and intra-multiplet transitions induced in atom-atom collisions within the framework of a molecular theory was discussed in many papers (e.g. [1]) and textbooks (e.g. [2]). In particular, angular momentum relaxations of polarized atoms due to atom-atom collisions, give a good indication about the accuracy of anisotropic molecular potentials.
We measured the decay rate of axially polarized neon atoms (alignment) in the $2p_2$ (in Paschen notations) state due to helium atom collisions in a temperature controlled glow discharge cell with laser induced fluorescence spectroscopy (LIFS). The experimental results were compared with those from the full quantum calculations of the alignment relaxation cross sections [3] based on the model potential of Hennecart and Masnou-Seeuws [4]. Above 77 K the theory and experiment were found to be in excellent agreement while the experimental values showed a more rapid decrease with the decrease in temperature from 40 to 15 K than the theoretical results. This finding suggests that the cross section rapidly decreases as decrease in the collision energy below a few meV.
Effects of a magnetic field on alignment relaxation collisions may be of interest because the Zeeman splitting make the collision inelastic. Recent development of cryogen free superconductive magnet systems has made us possible to perform optical measurements in a strong magnetic field with high flexibility. With such a magnet system, we may examine the magnetic-field dependence of the alignment relaxation at a cryogenic temperature. In this paper, we report the LIFS measurement of alignment relaxation of the $2p_2$ neon atoms at the liquid nitrogen temperature under a strong magnetic field.

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