ELECTROMAGNETICALLY INDUCED TRANSPARENCY FOR X-RAYS IN LASER-DRESSED NEON

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INTRODUCTION

The theoretical prediction of electromagnetically induced transparency (EIT) for x-rays in laser-dressed neon atoms was reported last year [1]. It was predicted that the presence of a laser modifies the final states accessible in K-shell excitation of Ne and that the laser-induced coupling of these states results in a strong suppression of the $1s^{-1}3p$ transition compared to that of the laser-off case. Critical for the efficiency of the laser-induced suppression of resonant x-ray absorption in Ne is the energy splitting between the $1s^{-1}3s$ and $1s^{-1}3p$ states. In Ref. [1], this energy splitting was calculated using the Hartree-Fock-Slater (HFS) mean-field method, with a result of 1.69 eV.

RESULTS

Motivated by an ongoing experiment by the Argonne Atomic Physics group, we have performed improved calculations of the energy splitting between $1s^{-1}3s$ and $1s^{-1}3p$, in order to verify that the EIT effect is, in fact, as strong as predicted in Ref. [1]. Here, we present new results for EIT at the $1s \rightarrow 3p$ resonance in Ne, obtained using more accurate atomic energy levels. We calculated these energy levels using two independent approaches. In the first approach, we employed nonrelativistic many-body perturbation theory to first order. In the second approach, we combined the Dirac-Fock method with the relativistic configuration interaction method. Both approaches give an energy splitting of 1.88 eV. We find that the resulting changes in the x-ray absorption spectrum of laser-dressed Ne are small in comparison to the predictions of Ref. [1], and expect that at a laser intensity of 10^{13} W/cm^2, the $1s \rightarrow 3p$ x-ray absorption cross section of Ne is suppressed by a factor of 13.

REFERENCES

1. C. Buth, R. Santra, and L. Young, Physical Review Letters **98**, 253001 (2007).

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