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Photoionization of some closed shell atoms and ions

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Abstract. Dipole-allowed single photoionization of some closed shell atoms and ions has been investigated in the relativistic random-phase approximation (RRPA). Application of relativistic-multichannel quantum defect theory (RMQDT) is made together with RRPA to analyse autoionizing resonances. Analysis points to the importance of interchannel coupling in high energy photoionization and reveals various degeneracies in relativistic atomic spectra to influence the low energy dynamics. Interesting threshold behavior in photoelectron spin polarization has been seen. Prospective future studies have been indicated.

Keywords. Atomic physics; photoabsorption.

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1. Introduction

Photoionization is considered to be a useful method to carry out spectroscopical and dynamical investigations on atomic systems, as the information thus obtained is of relatively pure form. This is simply because the photon field couples very weakly with the system to induce minimal perturbation. Moreover, since the final channel comprises of only the photoelectron, the incoming photon being absorbed by the target, the analysis becomes rather simple.

Over the last several decades there have been many experimental studies [1] on atomic photoionization to understand the dynamics of the process. In recent times, owing to the advent of experimental technology, a renewed interest is seen in high precision measurements. For a long time, the main obstacle to extensive experimental research at energies as low as x-ray range has been the limitation of discrete characteristic lines from x-ray tubes. Currently available x-ray synchrotron radiation facilities remove this obstacle and provide the experimentalists with an intense, tunable, and highly polarized x-ray beam. Laboratory research thus receives a major boost from such developments toward high resolution photoionization measurements [2, 3]. Measurements of photoionization angular distribution, that require an angle-resolved spectroscopy, have revealed interesting new information. We illustrate in the following two most recent works on non-resonant photoionization. Importance of effects beyond conventional dipole effects for inner-shell at relatively low energy photoemission has been realised [4, 5]. For argon 1*s*, krypton 2*s*, and krypton 2*p* photoemission, pronounced non-dipole asymmetries with respect to the direction of photon propagation have been seen [4]. With the increase of photon-energy