A.3.8. Coherent Elliptical State Rydberg Atoms: Dynamics in Crossed E and B Fields-- *B.D. DePaola, E. Horsdal-Pedersen**

The production of CES relies on adiabatic transformation in time-dependent crossed E and B fields. For the future production of CES by transformations tailored to the particular application and the manipulation in general of Rydberg states of a given shell, it is important to have detailed knowledge of the dynamics of hydrogenic or near-hydrogenic shells in such fields. In a broader context, the dynamics of the full shell in macroscopic external fields is closely related to the theory of distant ion-atom collisions involving Rydberg atoms or highly charged ions. With this in mind we have pursued our investigations of the dynamics of CES in crossed E and B fields. In this work the principal quantum number, *n*, was held fixed at 25, the B field was varied from approximately 10 to 100 gauss (but held fixed in time), and E was varied over several ranges and at several constant rates. The production and evolution of CES was studied as a function of these variables through the use of electric field ionization. The results [publication #113] show that the dynamics of a Rydberg shell in a time-dependent electric field and a constant magnetic field are described by a single scaling parameter $\zeta = \sin\phi / \sqrt{n\varepsilon}\, B$. A theory for purely hydrogenic systems describes near-adiabatic evolution of initial CES very well and explains the appearance of the parameter ζ, which is related to the Landau-Zener transition probability for a two-state problem. This work was carried out at the University of Aarhus and was the master's thesis work of P. Sorensen at that institution.

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