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Electric-field and two-photon excitation calculations for BEC-ion interaction experiments STEPHANIE MILLER, DAVID ANDERSON, GEORG RAITHEL, University of Michigan — We present progress toward implementing experiments investigating the interactions between Bose-Einstein Condensates (BEC) and ultra-cold ions. In such experiments, the interaction region needs to be free of stray electric fields in order to avoid premature extraction of the ion from the BEC, which requires field control of less than 100 μV/cm. Here, we report on the modeling of the electric-field and the ion-imaging characteristics for several setups. To further improve the electric-field shielding of the ion-BEC interaction region, we consider a two-photon excitation and adiabatic wave function control scheme in which a high-n circular-state Rydberg atom is prepared on a BEC. The circular Rydberg atom has a small quadratic Stark shift, which serves to efficiently shield electric fields from the center of the atom, where the atom's ionic core interacts with BEC atoms. Towards this novel approach, we calculate two-photon Rydberg-atom excitation rates for different combinations of laser polarizations and ground states in weak crossed electric and magnetic fields, which are required in the utilized circular-state preparation scheme.

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