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Excited State Atom-Ion Charge-Exchange¹ MING LI, CONSTANTINOS MAKRIDES, ALEXANDER PETROV, SVETLANA KOTOCHIGOVA, Department of Physics, Temple University, Philadelphia, PA 19122 — We theoretically investigate the exothermic charge-exchange reaction between an excited atom and a ground-state positive ion. In particular, we focus on MOT-excited $\text{Ca}^*(4s4p\ ^1P)$ atoms colliding with ground-state Yb^+ ions, which are under active study by the experimental group of E. Hudson at UCLA [1]. Collisions between an excited atom and an ion are guided by two major contributions to the long-range interaction potentials, the induction C_4/R^4 and charge-quadrupole C_3/R^3 potentials, and their coupling by the electron-exchange interaction. Our model of these forces leads to close-coupling equations for multiple reaction channels. We find several avoided crossings between the potentials that couple to the nearby asymptotic limits of Yb^*+Ca^+ , some of which can possibly provide large charge exchange rate coefficients above 10^{-10} cm^3/s . [1] W. G. Rellergert, S. T. Sullivan, S. Kotochigova, A. Petrov, K. Chen, S. J. Schowalter, and E. R. Hudson, Phys. Rev. Lett. 107, 243201 (Dec 2011).

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