Coulomb four-body problem near threshold in a classical framework

AGAPI EMMANOUILIDOU, School of Physics, Georgia Institute of Technology, JAN MICHAEL ROST, Max Planck Institute for the Physics of Complex Systems — We obtain the triple ionization probability from the ground state of Lithium and find it to be in remarkably good agreement with the experiment results [1]. In addition, we confirm the Wannier threshold law \( \sigma \propto E^\alpha \) for four-body breakup of Lithium with an exponent of \( \alpha = 2.16 \) in the energy range \( 0.9 - 2 \) eV and it is shown that the experimentally obtained \( \alpha [1] \) deviates from the theoretically obtained value due to its determination between \( 2 - 5 \) eV above threshold. Most importantly in the framework of classical dynamics we develop a new classification scheme for multi-electron trajectories in terms of sequences of binary electron collisions [2]. We believe that this classification scheme is applicable to a general three-electron dynamics. Surprisingly, for the angular distribution of the ionized electrons, we do not find a preferential symmetric break-up with an inter-electronic angle of 120° as predicted by Wannier's theory. Instead we find an angular pattern with two peaks at 90° and 180°. However, we show how the angular pattern we obtain is consistent with our analysis in terms of binary collisions. [1] R.Wehlitz, T. Pattard, M.-T. Huang, I. A. Sellin, J. Burgdorfer, and Y. Azuma, Phys. Rev. A 61, 030704 (R) (2000). [2] A. Emmanouilidou and J. M. Rost, submitted, xxx.lanl.gov/abs/physics/0409034

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