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Laser-Cluster Interaction: X-Ray Production by Short Laser Pulses[1] C. DEISS, N. ROHRINGER, J. BURGDÖRFER, ITP, Vienna U. of Technology, A-1040 Vienna, Austria, EU, E. LAMOUR, C. PRIGENT, J.-P. ROZET, D. VERNHET, INSP, Universités Paris 6 et 7, Campus Boucicaut, 75015, Paris, France, EU — Recent experiments on the interaction of large rare-gas clusters (number of atoms N >10000) with short intense infrared laser-pulses found characteristic x-ray emission at moderate ($\sim 10^{15}\mathrm{Wcm}^{-2}$) intensities. The ponderomotive energy of the electrons at these intensities is by far too low to create the K-shell vacancies (2 keV to 4 keV) which are the precursors of x-ray radiation. In order to investigate the mechanisms for efficient heating of quasi-free electrons in a cluster, we developed a mean-field classical transport simulation to describe the electronic dynamics. Our model takes into account the interaction of the electrons with the laser field, the build-up of an overall charge of the cluster due to electrons leaving the cluster, the resulting cluster expansion, polarization of the cluster due to collective electron motion, electron-impact ionization, and elastic scattering of the electrons by the ions inside the cluster. Elastic large-angle backscattering of electrons at ionic cores in the presence of a laser field is shown to be essential at low laser intensities. Results for the absolute x-ray yields are in surprisingly good quantitative agreement with experimental results.

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