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Ultrarelativistic electron generation during the intense laser pulse interaction with clusters YUJI FUKUDA, YUTAKA AKAHANE, MAKOTO AOYAMA, YUKIO HAYASHI, TAKAYUKI HOMMA, NORIHIRO INOUE, MASAKI KANDO, SYUHEI KANAZAWA, HIROMITSU KIRIYAMA, SYUJI KONDO, HIDEYUKI KOTAKI, SHINICHI MASUDA, MICHIAKI MORI, ATSUSHI YAMAZAKI, KOICHI YAMAKAWA, Japan Atomic Energy Agency, EUGENIYA ECHKINA, IGOR INOVENKOV, Moscow State University, JAMES KOGA, SERGEI BULANOV, Japan Atomic Energy Agency — Collimated relativistic electrons up to 58 MeV with an electron charge of 2.1 nC were generated by the interaction of intense laser pulses with the Ar cluster target at the laser intensity of 3.5×10^{19} W/cm^2. The resulting spectrum does not fit a Maxwellian distribution, but is well described by a two-temperature Maxwellian, which indicates two mechanisms of the electron acceleration. Two dimensional particle-in-cell simulations demonstrate an important role of clusters. The higher energy electrons are injected when they are expelled from the clusters by the laser pulse field. They then gain their energy during the direct acceleration by the laser pulse, whose phase velocity in the underdense plasma is larger than speed of light in vacuum. The lower energy electrons, which are injected during the plasma wave breaking, are accelerated by the wakefield.

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