Abstract for an Invited Paper
for the APR06 Meeting of
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**Ion acceleration in laser-irradiated micro-clusters**[1]

ALEXEY AREFIEV

A theory has been developed to describe ion acceleration in dense laser-irradiated clusters that are smaller than the laser wave-length [1]. The theory reveals that the breakdown of quasineutrality affects cluster dynamics in a dramatic way: the laser can create a positively charged ion shell that expands due to its own space-charge much faster than the central part of the cluster. The theory also shows a trend for the electrons to have a two-component distribution: a cold core that responds to the laser field coherently and a hot halo that undergoes stochastic heating. The hot electrons expand together with the equal number of ions accelerated to supersonic velocities in a double layer at the cluster edge. The mechanism produces ions with energies grater than the ponderomotive potential. A spectrum of ions produced by large clusters is found from a kinetic model of the hot-electron halo that takes into account electron cooling due to the cluster expansion. The halo makes ion spectrum anisotropic, which is consistent with recent experimental results. The theory of ion acceleration suggests that larger deuterium clusters can significantly enhance the neutron yield in laser-cluster experiments.

[1] B.N. Breizman and A.V. Arefiev, Phys. Plasmas 12, 056706 (2005).

[1]In collaboration with Boris Breizman, Institute for Fusion Studies, The University of Texas at Austin.