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**MeV electron acceleration at 1kHz with <10mJ laser pulses**[1]
FATHOLAH SALEHI, ANDY GOERS, GEORGE HINE, LINUS FEDER, DONGHOON KUK, KI-YONG KIM, HOWARD MILCHBERG, Univ of Maryland-College Park — We demonstrate laser driven acceleration of electrons at $1\,kHz$ repetition rate with $\sim pC$ charge above $1MeV$ per shot using $< 10\,mJ$ pulse energies focused on a near-critical density He or $H_2$ gas jet. Using the $H_2$ gas jet, electron acceleration to $\sim 0.5\,MeV$ in $\sim 10fC$ bunches was observed with laser pulse energy as low as $1.3mJ$. Using a near-critical density gas jet sets the critical power required for relativistic self-focusing low enough for $mJ$ scale laser pulses to self- focus and drive strong wakefields. Experiments and particle-in-cell simulations show that optimal drive pulse duration and chirp for maximum electron bunch charge and energy depends on the target gas species. High repetition rate, high charge, and short duration electron bunches driven by very modest pulse energies constitutes an ideal portable electron source for applications such as ultrafast electron diffraction experiments and high rep. rate $\gamma$-ray production.

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