Effects of Neon Dopant on LWFA with Multi-PW Laser Pulses

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We perform laser wakefield acceleration in a helium gas cell containing neon dopant by applying 2.5-PW laser pulses [1]. In the experiment, we observed that 1% neon neon dopant significantly enhanced the energy spread, charge, and divergence of electron beams, compared to the case of a pure helium medium. In numerical analyses using particle-in-cell simulations, we discovered that the sequential ionization of neon dopants played a crucial role in laser propagation, whereas the ionization injection [2] induced from inner-shell ionization of neon only occurred at the location of strong self-focusing. These results showed that neon dopant was crucial in producing high-quality multi-GeV electron beams with PW laser pulses. In addition, we will summarize recent research on laser electron acceleration and the development of radiation sources utilizing multi-PW laser pulses at CoReLS, IBS.

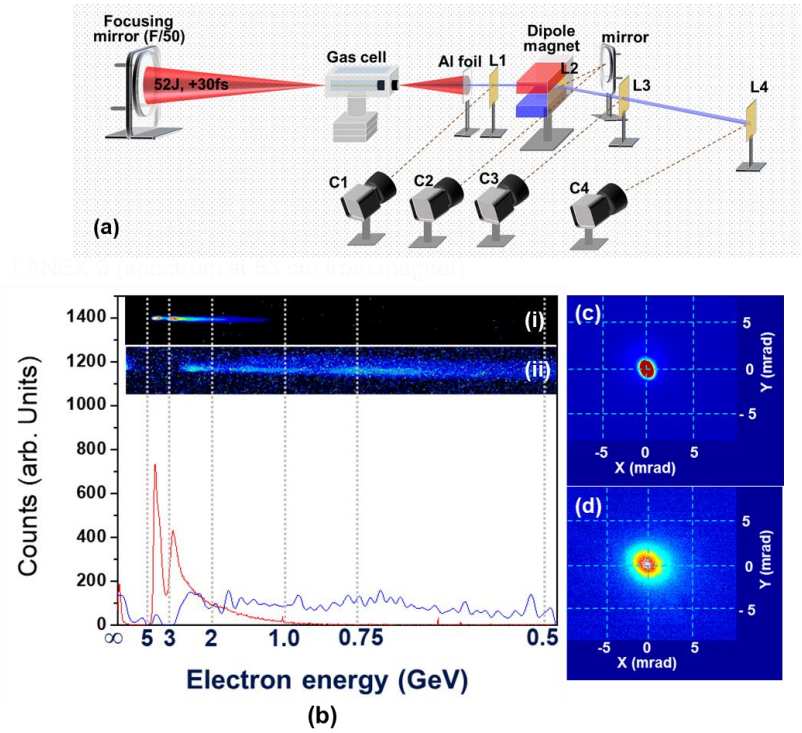

Figure 1. (a) Experimental layout (b) Electron energy spectra with and without 1-% Ne dopant. Inserts show the spectral images (i) with and (ii) without dopant. (c) and (d) show electron beam profiles recorded on C1 with and without Ne dopant, respectively.

References

[1] J. H. Sung et al., Opt. Lett. 42, 2058 (2017).
[2] A. Pak et al., Phys. Rev. Lett. 104, 025003 (2010)