Laser-driven ion acceleration through controlled motion of electrons by standing waves

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The generation of high-energy ions via the interaction of high-intensity femtosecond laser pulses with various targets provides a promising basis for a new kind of compact ion sources, with numerous applications in medicine, industry and science. Over the last couple of decades, extensive theoretical and experimental studies have made it possible to identify several favourable interaction regimes and has led to the development of related acceleration schemes. Many of these schemes, however, inherently lack well-controlled acceleration stages and thus provide only limited opportunities for a controlled generation of a well-collimated, high-charge beam of ions and with a given energy.

In an effort to alleviate this problem, it was recently proposed that the ions can be dragged by an electron bunch trapped in a controllably moving potential well formed by laser radiation. Such *standing-wave acceleration* (SWA) can be achieved through reflection of a chirped laser pulse from a mirror, which has been formulated as the concept of *chirped-standing-wave acceleration* (CSWA) [1].

In this contribution we further analyze general feasibility aspects of the SWA approach and demonstrate its reasonable robustness against field structure imperfections, such as those caused by misalignment, elliptical polarization and limited contrast. Using this we also identify prospects and limitations of the CSWA concept [2].

References

[1] F. Mackenroth, A. Gonoskov, and M. Marklund, Phys. Rev. Lett. **117**, 104801 (2016).

[2] J. Magnusson, F. Mackenroth, M. Marklund, and A. Gonoskov, arXiv:1801.06394.