Attosecond pulse from laser-irradiated near-critical-density plasmas

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The birth of high-intensity attoseocnd source has extended human measurement and control techniques into atomic-scale electronic dynamics. High harmonic generation from laser-plasma interaction has been regarded as one of the most promising routes to obtain such attosecond light. Here, we propose a new practical approach of obtaining intense attosecond pulses by a laser pulse interacting with near-critical-density (NCD) plasmas. The unique interaction dynamics in NCD plasmas have been identified theoretically and by particle-in-cell simulations (Fig. 1), which show that three distinct dense electron nanobunches are formed each half a laser cycle and two of them can induce intense attosecond pulses in respectively the reflected and transmitted directions by the so-called "coherent synchrotron emission" (CSE) mechanism. Comparing with CSE in solids, not only the required stringent conditions on laser and target are relaxed, but also the radiation intensities are enhanced by two orders of magnitude.

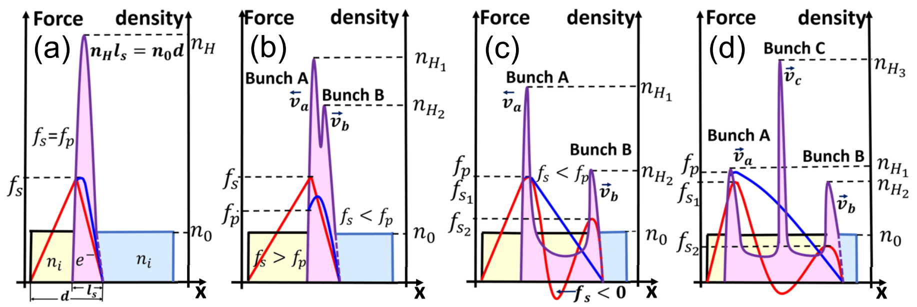

Figure 1: *Schematic figures to show different nonlinear dynamics at different moments in NCD targets*

References

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