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## Generation of attosecond electron bunches through terahertz regulation

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Obtaining ultrashort electron bunches is the key to the studies of ultrafast science, yet second and higher order nonlinearities limits the bunch length to a few femtoseconds after compression. Traditional regulation methods using rf higher order harmonics have already optimized the bunch length to sub-fs scale, yet the energy loss and rf jitter are not negligible. In this paper we demonstrate the second order regulation with THz pulses through a dielectric-loaded wave-guide. Simulations suggest that with higher order correction, the MeV electron bunches with tens of fC charges can be compressed to a 679 attoseconds rms and the second order distortion can be compensated. The transverse beam size is also optimized to 16.8  $\mu\text{m}$  rms. This scheme is feasible for a wide range of electron charges. The relatively short bunch length is expected to find a better time resolution in UED, UEM and other ultrafast, time-resolved studies.

### Footnotes

### Funding Agency

### Paper preparation format

### Region represented

Asia

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