DAMOP17-2017-020026

Abstract for an Invited Paper
for the DAMOP17 Meeting of
the American Physical Society

A self referencing attosecond interferometer with zeptosecond precision[1]

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We present a controlled interferometric measurement of two beating train of attosecond pulses. The attoseond pulse train is generated by higher order harmonics from two sources in a gas phase. By controlling the offset phase between the two train of attosecond pulses we are able to measure the phase of all the harmonics relative to the offset phase of the fundamental f_0. Somewhat surprisingly we find that the phase evolution for all the measured harmonics follows the linear relation $\delta\phi_q = (2n+1)f_0$. This represents an ideal source for heterodyne spectroscopic measurements in the XUV regime. Phase measurements were performed with a resolution of 12.5 attoseconds or half of the atomic unit of time. The precision of the measurement is in the hundreds of zeptoseconds which can be enhanced in further experiments. Finally, no carrier-envelope phase stabilization nor generation of isolated attosecond pulses is required for the presented measurements, thus reducing the complexity of future experiments.

[1]U.S. Department of Energy (DOE), Office of Basic Energy Sciences, Chemical Sciences, Geosciences, and Biosciences Division, (DE-FG02-86ER13491)