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A self-referencing attosecond interferometer[1] JAN TROSS, GEORGIOS KOLLIOPOULOS, CARLOS A. TRALLERO-HERRERO, James R. Macdonald Laboratory, Department of Physics, Kansas State University, Manhattan, KS 66506 — We demonstrate an experimental tool for the controlled interferometric measurement of two beating trains of attosecond pulses with 13 attoseconds in resolution and hundreds of zeptoseconds in precision. The attosecond pulse train is generated by higher order harmonics from two sources in a gas medium. By controlling the offset phase between the two trains of attosecond pulses we are able to measure the phase difference of the harmonics, emanated from the two distinct sources, relative to the offset phase of the fundamental f_0. We find that the phase difference evolution for all the measured harmonics follows the linear relation $\delta\phi_q = (2n+1)f_0$, q being the harmonic order. This represents an ideal source for homodyne 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.

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