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An Optically-Locked Interferometer for Attosecond Pump Probe Setups[1] JOHN VAUGHAN, JOSEPH BAHDER, BRADY UNZICKER, DAVIS ARTHUR, MORGAN TATUM, TREVOR HART, GEOFFREY HARRISON, SPENSER BURROWS, PATRICK STRINGER, GUILLAUME LAURENT, Auburn University — Ultrafast pump-probe measurements at the attosecond time scale are generally achieved by exposing the target to both an attosecond pump pulse and a phase-locked IR probe field, with a variable time delay between the two. To fully exploit the temporal resolution of attosecond pulses for time-resolved studies, the time delay between the pump and probe pulses must be controlled with attosecond resolution as well. This requires the ability to linearly vary the delay with time steps of the order of the pulse duration (or less), and maintain it to any desired value over extended periods of time. We present the design and performance of an active stabilization system for attosecond pump-probe setups based on a Mach-Zehnder interferometer configuration. The system employs a CW laser propagating coaxially with the pump and probe beams in the interferometer. The stabilization is achieved with a standalone feedback controller that adjusts the length of one of its arms to maintain a constant relative phase between the CW beams. With this system, the time delay between the pump and probe beams is stabilized within 10 as rms over several hours.

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