Multilayer optics for Femtosecond/Attosecond Sources

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Recent developments in high harmonic sources and free electron lasers are enabling femtosecond and even attosecond extreme ultraviolet (EUV) and x-ray pump/probe dynamics studies. To allow for the full utilization of these ultrafast sources equal developments in multilayer optics to shape and control these pulses are needed. For example, the attosecond pulses from a high harmonic source arrive in a train of pulses separated by half the fundamental frequency of the driving laser. Often for pump/probe measurements it is desirable to obtain an isolated pulse. Using modern laser technology it is possible to create an isolated attosecond pulse for a high harmonic source, however, the implementation often adds a large layer of complexity to the laser and experiment. Semi-isolated harmonic pulses can be obtained by creating a multilayer Fabry-Perot interference coating that causes destructive interference conditions for all but the first pulse. Such optics could simplify the implementation of the lasers used in high harmonic sources.

Work on controlling and measuring the reflected phase and amplitude for ultrafast EUV and x-ray pulses will be presented along with developments in EUV and X-ray multilayer optics that can produce semi-isolated attosecond pulse from long high harmonic pulse trains. Possible implementations of two-color for x-ray pump / x-ray probe multilayer optics will be discussed as well.