Title:	Development of ultrathin delay line for attosecond resolved high harmonics and interferometric applications
Authors:	Dahiya, Sunil
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Abstract:	The study of light-matter interaction at an ultrafast time scale of femtosecond and attosecond is quite exciting and gives an understanding of quantum behaviour in atoms and molecules. A lot of efforts have been made regarding building up the tools and techniques to understand these interactions. Here, we are trying to develop a tabletop attosecond pulse source through high harmonics generation process in gases using a highly intense femtosecond laser. We aim to develop an optical delayline/interferometer capable of measuring and controlling attosecond resolved dynamics. Optical delay lines with attosecond resolution and ultrahigh stability are the important tools of atto-science and technology for various applications such as characterization of ultrashort pulses and pump-probe spectroscopy in atomic and molecular medium. For attosecond controlled measurements of electron dynamics, it is necessary to have a reference of absolute-zero time delay which demands nanometer scale matching between the interferometer arms which is challenging with conventional designs having low stability and resolution. Hence, it is important to have a delay line with attosecond resolution and high stability providing zero delay reference for experiments using ultrashort pulses. We have developed and realised a compact ultra-thin attosecond optical delay line of sub 10 attosecond resolution and around 2 attosecond stability providing time zero reference with negligible dispersion effects. The performance of the delay line is validated by observing attosecond resolved oscillations in the yield of high-harmonics induced by two time delayed infrared femtosecond pulses. This ultrathin delayline is also used as an autocorrelator to characterize the femtosecond pulses in the time domain. Also, we demonstrate a tunable wavefront split ultrathin white light interferometer enabling picometer resolution of optical path difference. We have used it for the measurement of temporal coherence length of several broadband incoherent sources as small as a few micrometers. The presented design overcomes the major challenges in the existing delaylines for ultrafast attosecond measurements. This ultrathin delayline can be used with various applications in ultrafast science for attosecond resolved measurements such as photoionization of atomic and molecular systems.
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