ABSOLUTE-PHASE-RESOLVED STRONG FIELD IONIZATION

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Many important physical processes such as non-linear optics and coherent control are highly sensitive to the absolute carrier-envelop-phase (CEP) of driving ultrashort laser pulses. A significant amount of previous theory work has been carried out to study the effect of the absolute CEP on strong-field ionization and related phenomena such as high harmonic generation (HHG) and nonsequential double ionization (NSDI). This makes the measurement of absolute CEP in the photoionization process immensely important in attosecond and strong-field physics. Even though relative CEPs can be measured with a few existing methods, the estimate of the absolute CEP has not been straightforward and has always required theoretical inputs. Recently, we have developed an in-situ method for measuring the absolute CEP of elliptical polarized few-cycle pulse without the assistance of theoretical modelings. Here we will show that the absolute CEP of linear polarized light can also be measured with a similar method. This capability enables the measurement of absolute-phase-resolved strong field ionization for the first time. We are able to compare the experimental results directly with those obtained with numerical solutions of time-dependent Schrodinger equations (TDSE). Preliminary results suggest the TDSE method might have issues in modeling strong field multi-electron dynamics, which have been routinely carried out to help understand the dynamics or calibrate CEP measurement. This failure could be due to the employed single active electron approximation and warrants further investigation. The results of this study will provide theorists with a clear standard for studying strong-field ionization processes in atoms and molecules and will lead to independent experimental measurements of the absolute phase.