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Attosecond all-optical light field sampling.¹

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The light field sampling is crucial in attosecond time-resolved spectroscopic measurements. The sampling of a light field—triggers the ultrafast dynamics in time-resolved spectroscopic measurements—allows for a direct connection between the driver field and the measured dynamics trace as it evolves in time. Currently, the available light field metrology approaches (i.e., attosecond streaking and Attoclock) are based on the generation of the attosecond XUV pulses. These methodologies require a fully equipped XUV beamline included the generation of XUV pulses by High Harmonic Generation (HHG), attosecond XUV pulse isolation, and a sophisticated and complex laser pump-XUV probe setup. Such a beamline is costly and technically complicated. Hence, the ultrafast research field calls for a new direct and simple approach for light field characterization. Here, we exploited this light field-driven electronic response and the related reflectivity modulation in dielectric to demonstrate an all-optical light field sampling methodology with attosecond resolution. This approach can be used under any experimental conditions, thus enabling the direct connection between the sub-femtosecond triggering field and the measured dynamics in potential time-resolved measurements, providing more insight into the physics of ultrafast dynamics in matter. Also, this simple field sampling metrology promises a profound advancement in ultrafast and attosecond science fields.

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