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Asynchronous and Interferometric Nonlinear Spectroscopy (AI-NS)

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Since the advent of time-resolved spectroscopy based on precision frequency technology of laser sources, it has been considered an alternative way to study dynamic processes in photochemical systems. Recently, we have developed asynchronous and interferometric nonlinear spectroscopy (AI-NS), a spectroscopic technique that combines asynchronously generated laser pulses and interferometric detection. This technique offers an unprecedented temporal dynamic range with high spectral resolution and rapid data acquisition capabilities. By eliminating the need for mechanical delay stages, AI-NS facilitates the rapid collection of time-resolved data on dynamics ranging from femtoseconds to nanoseconds, while simultaneously distinguishing frequency-dependent responses. Here, we detail the technical methodology of AI-NS and explore its applications to the studies of various systems, including semiconductors and biological systems. Additionally, we highlight prospective advancements, such as integration with multidimensional spectroscopy techniques. AI-NS not only expands the scope of spectroscopic analysis but also opens new avenues for the exploration of diverse materials and molecular systems.

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