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Coincidence electron/ion imaging with a fast frame camera WEN LI, SUK KYOUNG LEE, YUN FEI LIN, STEVEN LINGENFELTER, ALEXANDER WINNEY, LIN FAN, Wayne State University — A new time- and position-sensitive particle detection system based on a fast frame CMOS camera is developed for coincidence electron/ion imaging. The system is composed of three major components: a conventional microchannel plate (MCP)/phosphor screen electron/ion imager, a fast frame CMOS camera and a high-speed digitizer. The system collects the positional information of ions/electrons from a fast frame camera through real-time centroiding while the arrival times are obtained from the timing signal of MCPs processed by a high-speed digitizer. Multi-hit capability is achieved by correlating the intensity of electron/ion spots on each camera frame with the peak heights on the corresponding time-of-flight spectrum. Efficient computer algorithms are developed to process camera frames and digitizer traces in real-time at 1 kHz laser repetition rate. We demonstrate the capability of this system by detecting a momentum-matched co-fragments pair (methyl and iodine cations) produced from strong field dissociative double ionization of methyl iodide. We further show that a time resolution of 30 ps can be achieved when measuring electron TOF spectrum and this enables the new system to achieve a good energy resolution along the TOF axis.

Wen Li
Wayne State University

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