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Probing the dynamics of dark states using four-wave mixing processes in the XUV[1] NATHAN HARKEMA, SERGIO YANEZ-PAGANS, ARVINDER SANDHU, University of Arizona — Attosecond transient absorption spectroscopy (ATAS) has been used to probe ultrafast electron dynamics by measuring small changes in absorption of an extreme ultraviolet (XUV) pulse. Recently, this spectroscopic technique has been extended to implement four-wave mixing (FWM) between XUV and IR pulses. These FWM experiments can produce a background-free signal which is easier to detect and interpret than conventional ATAS. We show non-collinear FWM is ideally suited for studying optically dark states which do not appear in the XUV spectrum. By carefully tuning the XUV and IR photon energies, we can excite dark states as an intermediate step in the FWM process. We implement this scheme in Argon, which has a series of optically dark autoionizing states. With an appropriate pulse sequence, we use the FWM signal to obtain the lifetimes of these dark states.

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