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IR-assisted ionization of Ar^+/Ar^{++} by the attosecond XUV radiation P. RANITOVIC, C.W. HOGLE, X. ZHOU, M.M. MURNANE, H.C. KAPTEYN, University of Colorado, JILA — The use of attosecond XUV and femtosecond IR radiation to induce and control electron dynamics in small atoms and molecules is a central theme of attosecond science. Here we use a 42 eV photon to excite an Ar^+Rydberg state just below the argon double-ionization threshold. A weak IR photon is then used to probe and control the excitation/ionization processes. The Ar+/Ar++ yields are monitored with sub-optical cycle attosecond relative delays between the XUV and IR pulses. When the IR probe arrives after the XUV pulse has excited well defined states of Ar^{+*}, a seven-times enhanced yield of Ar^{++} yield is seen compared with ionization without the IR pulse present. An additional enhancement (x10) in the Ar^{++} yield is seen when the XUV and IR pulses simultaneously excite Ar. Moreover, modulations in the Ar+/Ar++ yield are observed when the two beams are delayed on attosecond time scales. Photoelectrons are measured in coincidence with the ions using the COLTRIMS technique. The ionization mechanisms behind these observations will be discussed.

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