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Probing two-electron dynamics in helium with isolated attosecond pulses

ZENGHU CHANG, Kansas State University and University of Central Florida

High contrast single isolated XUV pulses with duration less than 150 as were generated with a double optical gating. When a helium atom is exposed to the attosecond field with photon energy above 60 eV, it is ionized through two quantum channels, i.e., the direct ionization from the ground state and the autoionization from the doubly-excited states. We demonstrated that by combining the attosecond pulse with a few-cycle femtosecond field, the lifetime of the doubly-excited states could be measured. Furthermore, the interference between the two quantum channels was controlled by the intense near infrared laser pulse.