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Attosecond double-slit experiment[1]

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A novel application of intense few-cycle laser pulses is demonstrated. Taking advantage of the unique properties of phase-controlled few-cycle pulses, a close analogue of the double-slit scheme has been realized in the time domain. It is distinguished from conventional schemes by a combination of characteristics: *(i)* The double slit is realized not in position-momentum but in time-energy domain. *(ii)* The role of the slits is played by windows in time of attosecond duration. *(iii)* These "slits" can be opened or closed by changing the temporal evolution of the field of a few-cycle laser pulse. *(iv)* At any given time there is only a single electron in the double-slit arrangement leading to the presence or absence of interference depending on emission direction. The experimental scheme is of similar plainness as the one of the double slit: Few-cycle laser pulses of given absolute phase are focused into a field-free vacuum chamber and intersect a beam of Argon atoms. Photoelectrons emitted parallel to the axis of polarization are detected by two electron detectors located at a distance of about 400 mm at either side of the focus. The time-of-flight is used to determine the energy of the electrons. The photoelectron spectra exhibit a fringe pattern whose visibility depends on the temporal evolution of the pulses as well as on the emission direction.

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