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Abstract:Significant molecular orientation can be achieved by time-symmetric single-cycle pulses of zero area, in the THz region. We show that in spite of the existence of a combined time-space symmetry operation, not only large peak instantaneous orientations, but also nonzero time-average orientations, over a rotational period, can be obtained. We show that this unexpected phenomenon is due to interferences among eigenstates of the time-evolution operator, as was described previously for transport phenomena in quantum ratchets. This mechanism also works for appropriate sequences of identical pulses, spanning a rotational period. This fact can be used to obtain a net average molecular orientation regardless of the magnitude of the rotational constant. (C) 2012 American Institute of Physics. [http://dx.doi.org/10.1063/1.4736844]

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