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The effects of molecular vibration on the yield of high-order harmonic generation. JIANGFAN XIA, MAHENDRA SHAKYA, SHAMBHU GHIMIRE, CHRIS NAKAMURA, ZENGHU CHANG, Phys. Dept. KSU — It is well-accepted that the high-order harmonic spectrum is the results of interference between many attosecond pulses. Each of the attosecond pulse is produced by a three-step process taking place within one laser cycle. For light molecules such as H_2, the first step is the ionization of one electron. When the freed electron returns to the H_2^+, the internuclear distance is changed. This may cause the electron to miss the ion during its revisit, thus reducing its probability to recombine with the parent ion. As a result, the high harmonic generation yield is lower for H_2 than D_2, since D_2 has a longer vibration period ($\sim$21 fs) than that of H_2 ($\sim$15 fs). Here we report, to the best of our knowledge, the first experimental observation of the effects of vibration on the yield of HHG in molecules. We compared the high-order harmonic spectra of H_2, HD and D_2. The shortest pulses were $\sim$8 fs, which is almost the same as one half of the vibration period of H_2. Using such short pulses assures that the internuclear distances of all three types of molecules are in the increasing phase of a cycle when the harmonics are generated. From the HHG spectra it is evident that the yield of D_2 is a factor of two higher than that of H_2, while that of HD is in between. This is consistent with the theoretical predictions.

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