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Molecular alignment and soft X-ray generation in the ultrafast intense laser field PENG LIU, Shanghai Institute of Optics & Fine Mechanics, CAS — Molecules can be strongly aligned non-adiabatically by using the two-pulse femtosecond laser field with an optimized delay time. We propose a novel strategy to determine the optimal timings of the two laser pulses to modify the molecular rotational wave packet, by which the molecular alignment generated by the first pulse is suppressed or enhanced by adjusting the respective delay times. This provides a way to actively control the molecular rotational wave packet. The underlying physics attributes to the selective population transfer of molecular rotations. We also experimentally investigate the high-order harmonic generation (HHG) from aligned CO_2 molecules and demonstrate that the modulation inversion of harmonic yield with respect to molecular alignment can be altered dramatically by the intensity of the driving laser pulse. The laser field dependent inversion can be explained by the shift angular distribution of harmonic emission calculated with the strong field approximation (SFA) model including a ground state depletion factor. The calculation result on angular distributions using SFA model is consistent with the experimental observations for the 19^{th} to 27^{th} harmonics.

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