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Selective Rotational Manipulations of Close Molecular Species – isotopes and isomers YEHIAM PRIOR, SHARLY FLEISCHER, ILYA SH. AVERBUKH, Department of Chemical Physics, Weizmann Institute of Science, Rehovot, Israel 76100 — We experimentally demonstrate a new approach to selective excitation of close molecular species in mixtures. We apply two time delayed, ultrashort laser pulses where the first pulse rotationally excites both components in a binary mixture, and the second pulse de-excites one, while enhancing the excitation degree of the other. In our work we implemented this approach to molecular nitrogen, and study the cases of molecular isotopes and molecular spin isomers. The case of molecular isotopes is based on the mass difference between the molecular components which results in a slightly different revival period of the repetitive alignment that follows excitation by an ultrashort pulse. Following the revival process, one can distinguish between the isotopic components and selectively affect them. The case of spin isomers is more complicated since there are no differences in their mechanical or electrical properties. Here we utilize the symmetry and statistics of the specific molecular wavefunction and demonstrate highly selective ($\sim$18:1) excitation of Ortho/Para nitrogen. Numerical simulations agree very well with the observed results. Since this process is nonresonant and does not require any special conditions like temperature etc. this approach is general and can be applied to most symmetric molecules.

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