Transient and Persistent Orientation of Chiral Molecules Induced by Laser Fields with Twisted Polarization

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Molecular chirality is an omnipresent phenomenon of fundamental importance in physics, chemistry, and biology. The search for novel techniques for enantioselective control, detection, and separation of chiral molecules is of particular importance. It has been recently predicted [1,2] that laser fields with twisted polarization may induce persistent enantioselective field-free orientation of chiral molecules. Here we report the first experimental observation of this phenomenon [3,4] using propylene oxide molecules (CH_3CHCH_2O, or PPO in short) spun by an optical centrifuge – a laser pulse, whose linear polarization undergoes an accelerated rotation around its propagation direction. We show that PPO molecules remain oriented on a time scale exceeding the duration of the centrifuge pulse by several orders of magnitude. The demonstrated long-time field-free enantioselective orientation opens new avenues for optical manipulation, discrimination, and, potentially, separation of molecular enantiomers.

References

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