Phase-Modulated Non-Resonant Laser Pulses can Selectively Convert Enantiomers in a Racemic Mixture

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Deracemization occurs when a racemic molecular mixture is transformed into a mixture containing an excess of a single enantiomer. Recent advances in ultrafast laser technology [1] hint at the possibility of using shaped pulses to generate deracemization via selective enantiomeric conversion, however experimental implementation remains a challenge and has not yet been achieved. Here, we suggest a simple, yet novel approach to laser-induced enantiomeric conversion based on dynamic Stark control [2,3]. We demonstrate theoretically that current laser and optical technology can be used to generate a pair of phase-modulated, non-resonant, linearly polarized Gaussian laser pulses that can selectively deracemize a racemic mixture of 3D oriented, 3,5-difluoro-3’,5’–dibromobiphenyl (F₂H₃C₆-C₆H₃Br₂) molecules, the laser-induced dynamics of which are well studied experimentally [4]. These results strongly suggest that designing a closed loop coherent control scheme [5] based on this methodology may lead to the first-ever achievement of enantiomeric conversion via coherent laser light in a laboratory setting.

References: