Optical separation and purification of enantiomers using coherent pulse sequences\(^1\)

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We discuss the theory of phase-sensitive stimulated symmetry breaking as applied to the separation and purification of (“racemic”) mixtures of chiral molecules into their right-handed and left-handed constituents (“enantiomers”). In particular, we discuss a new scheme by which one can use laser beams to spatially separate mixtures of trapped ultracold chiral molecules to the individual enantiomers, thereby emulating optically for gas phase molecules the chiral-crystals separation achieved by Pasteur using a pair of tweezers. We also discuss applications of the above to understanding the so-called “Hund Paradox,” namely that crystals of chiral molecules are always built from the symmetry-broken forms and never from the equal-energy symmetric or anti-symmetric forms.

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