

DAMOP10-2010-000115

Abstract for an Invited Paper
for the DAMOP10 Meeting of
the American Physical Society

Optical separation and purification of enantiomers using coherent pulse sequences¹

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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.

¹Supported by the Peter Wall Institute for Advanced Studies, The University of British Columbia.