

Alignment and orientation of molecules by strong laser pulses: Applications in laser controlled stereochemistry

Abstract:

Essentially all molecules are nonspherical objects and, consequently, their interactions with other molecules, atoms or radiation depend on their spatial orientation. Developments and applications of methods for controlling the spatial orientation of molecules has therefore been a topic of great importance and activity in molecular sciences for five decades. A significant advance in the ability to obtain orientational control of molecules was triggered in the late 90s when it was realized that moderately intense electromagnetic fields from pulsed lasers can align molecules along axes fixed in space.

In the current talk I will explain the basic principles and ideas of laser induced alignment and orientation, and account for the current state-of-the-art in this fascinating research field including fixing the 3-dimensional orientation of asymmetric top molecules and alignment control by ultrashort laser pulses. A particular emphasis will be on discussing recent applications of aligned and oriented molecules towards time resolved studies of torsion, and eventually enantiomeric conversion, of axially chiral molecules. Also, photoelectron spectroscopy from fixed-in-space molecules will be discussed.