XXIX International Conference on Photonic, Electronic, and Atomic Collisions (ICPEAC2015) IOP Publishing
Journal of Physics: Conference Series **635** (2015) 112053 doi:10.1088/1742-6596/635/11/112053

Nondipole Effects in Chiral Molecules Measured with Linearly Polarized Light

K.P. Bowen*[1], O. Hemmers*, R. Guillemin†, W.C. Stolte‡, M.N. Piancastelli§, D.W. Lindle*

*Department of Chemistry & Biochemistry, University of Nevada Las Vegas, Las Vegas, NV, USA
† Laboratoire de Chimie Physique – Matière et Rayonnement, Université Pierre et Marie Curie, CNRS UMR 7614, Paris Cedex 05, France
‡National Security Technologies, LLC (NSTec), Livermore Operations, Livermore, CA, USA
§ Department of Physics and Astronomy, Molecular and Condensed Matter Physics, Uppsala Universitet, Uppsala, Sweden

Synopsis: We present the first-ever measurement of nondipole chiral angular distribution parameters for C 1s photoemission from each enantiomer of camphor in the photon energy range 296-343eV using linearly polarized light. The angular distribution parameters are determined to be enantiomer-specific, suggesting a new form of linear dichroism.

Over the past two decades, it has been demonstrated that higher-order corrections to the dipole approximation are necessary for the description of light-matter interactions in the soft x-ray range. These so-called 'nondipole effects' present themselves as asymmetries in the angular distributions of photoelectrons. Chiral molecules, known to have asymmetries in photoelectron angular distributions when exposed to circularly polarized light, have been proposed to demonstrate a chiral-specific nondipole effect when exposed to linearly polarized light[1]. This chiral-specific contribution to the angular distribution of photoelectrons is characterized by the parameter ε, which introduces a "twisting" of the angular distribution in the plane containing the polarization and perpendicular to the incoming photon propagation. This study presents ε(hν) values, as well as the conventional angular distribution asymmetry parameter β(hν), for C 1s photoemission from both (R)-Camphor and (S)-Camphor, in the range of 5-50eV above the C 1s threshold.

The measurements were performed using electron time-of-flight (TOF) spectroscopy at the Advanced Light Source (ALS) at Lawrence Berkeley National Lab (LBNL) in Berkeley, CA.

The individual parameter values with respect to photon energy are presented in figures 1 and 2, respectively. The large difference in ε(hν) between enantiomers implies a new form of linear dichroism.

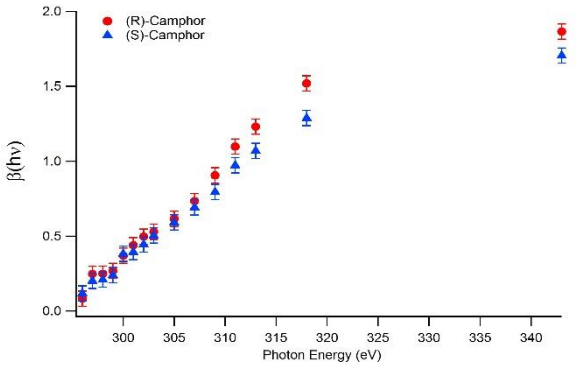

Figure 1. The anisotropy parameter β(hν) for C 1s photoemission from (R)-Camphor and (S)-Camphor

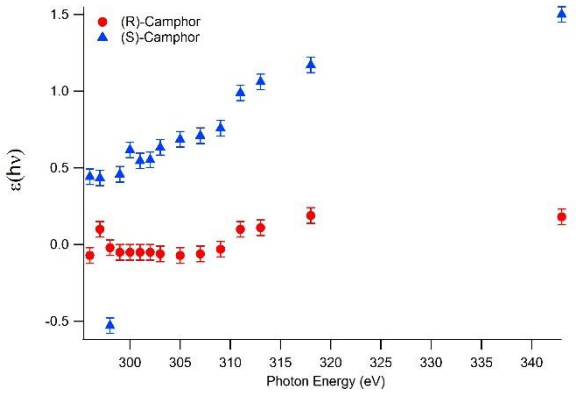

Figure 2. The chiral nondipole paremeter ε(hν) for C 1s photoemission from (R)-Camphor and (S)-Camphor

References

[1] A.N. Grum-Grzhimailo 2003 *J. Phys. B* **36** 2385

[1] Email: bowenk4@unlv.nevada.edu