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## Study of chiral asymmetries in the inner-shell photoionization of partially oriented trifluoro-methyloxirane

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**Synopsis** Photoelectron circular dichroism (PECD) was determined for O(1s) photoionization of methyloxirane (C<sub>3</sub>H<sub>6</sub>O) and trifluoro-methyloxirane (C<sub>3</sub>H<sub>3</sub>F<sub>3</sub>O). Several electron energies above the threshold were chosen to compare the partially fixed-in-space electron distributions.

When exceeding a certain size, most molecules become chiral in their structure: they exist as two enantiomers, which are mirror images of each other. Therefore they cannot be superimposed without breaking/rearranging of bonds. The common properties - as melting point, density etc. - of these enantiomers are the same, and even the rovibronic sublevels are identical (except the tiny effect of weak interaction). After ionization with a single photon the photo electron angular distribution is symmetric in forward/backward direction with respect to the light's propagation direction. It turns out that the combination of circularly polarized light and chiral molecules break this symmetry. This effect is called photoelectron circular dichroism (PECD) [1]. This rather strong orbital-dependent chiroptical effect reaches up to a few percent and shows rich photon energy dependence. In previous experiments we observed a strong enhancement of the PECD for uniaxially oriented methyloxirane (C<sub>3</sub>H<sub>6</sub>O) molecules [2]. In the current study, trifluoro-methyloxirane (C<sub>3</sub>H<sub>3</sub>F<sub>3</sub>O) was core photo-ionized, creating photoelectrons with either 4, 6, 8 and 11.5 eV, launched from the O(1s). The energies were chosen to give an overall maximum positive,

negative or 0 PECD signal [3]. The experiments were conducted on SEXTANTS beamline at the Synchrotron SOLEIL using the well-established COLTRIMS (Cold Target Recoil Ion Momentum Spectroscopy) technique [4]. High-efficiency-MCPs combined with a mesh-free spectrometer were used to enhance the multiple particle detection efficiency [5]. This allows post-orienting the molecule not only by one-axis, but also by two or even in 3d and even determining the absolute handedness [6,7]. Alternating between right- and left-handed circularly polarized radiation the PECD in the angular distribution was extracted from the photoelectron images obtained in coincidence with the molecular break-ups and compared for the 11.5 eV case with the results for C<sub>3</sub>H<sub>6</sub>O.

### References

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