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Chiral Sensitivity in the Dissociative Electron Attachment of Halocamphor Molecules¹

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We have demonstrated chirally-dependent molecular destruction when incident longitudinally-spin-polarized (chiral) electrons break bonds in chiral molecules. This chiral sensitivity was observed through an asymmetry in the dissociative electron attachment (DEA) reaction rate with chiral 3-bromocamphor ($C_{10}H_{15}BrO$) [1]. Such an observation provides an unambiguous demonstration of the idea underlying the Vester-Ulbricht hypothesis [2], which attempts to explain the origins of the homochirality that is observed in many biological systems. While the lack of inversion symmetry in these reactions allows the effects we observe to occur, their dynamic causes are poorly understood [3]. We have further studied the asymmetries in the DEA rates for two additional halocamphor molecules, 3-iodocamphor ($C_{10}H_{15}IO$) and 10-iodocamphor, in a systematic effort to illuminate the mechanisms responsible for the chiral sensitivity. The DEA signal depends on the sign of the incident electron helicity for a given target handedness in all molecules, and it varies with both the atomic number and the location of the heaviest atom in the molecule. Surprisingly, the DEA asymmetries for 10-iodocamphor, in which the heaviest atom is farther from a chiral center than for the other molecules, produced the largest asymmetries. This work was performed at the University of Nebraska-Lincoln. [1] J.M. Dreiling and T.J. Gay, *Phys. Rev. Lett.* **113**, 1181 (2014). [2] T.L.V. Ulbricht and F. Vester, *Tetrahedron* **18**, 629 (1962). [3] T.J. Gay, in *Advances in Atomic, Molecular, and Optical Physics*, **57**, 157 (Academic Press, Burlington, 2009).

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