Investigation of the Effects of Atomic Number and Constitution on Chirally-Sensitive Electron-Induced Molecular Breakup

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\[ A = \frac{[(I_L^\uparrow - I_L^\downarrow)/(I_L^\uparrow + I_L^\downarrow)]_L - [(I_R^\uparrow - I_R^\downarrow)/(I_R^\uparrow + I_R^\downarrow)]_R}{[(I_L^\uparrow - I_L^\downarrow)/(I_L^\uparrow + I_L^\downarrow)]_L + [(I_R^\uparrow - I_R^\downarrow)/(I_R^\uparrow + I_R^\downarrow)]_R}, \]

where \( I_L^\uparrow \) (\( I_R^\downarrow \)) is the current measured for spin-up (spin-down) electrons and the “L” and “R” subscripts correspond to the left- and right-handed chirality of the molecules [1]. Two electron-molecule interaction channels were studied: electron transmission (related to the total scattering cross section) and dissociative electron attachment (DEA). Three halocamphor molecules were investigated: 3-bromocamphor (C\(_{10}\)H\(_{15}\)BrO), 3-iodocamphor (C\(_{10}\)H\(_{15}\)IO), and 10-iodocamphor. While the transmission asymmetry data do not show a strong molecular dependence, the DEA asymmetries collected for bromocamphor and iodocamphor are qualitatively different, suggesting that the atomic number of the heaviest atom in the molecule plays a crucial role in the asymmetric interactions. The DEA asymmetry data for 3- and 10-iodocamphor have the same qualitative behavior, but the 10-iodocamphor asymmetry is about twice as large at the lowest energies investigated, so the location of the heavy atom in the camphor molecule also affects the asymmetries. [1] J.M. Dreiling and T.J. Gay, Phys. Rev. Lett. 113, 118103 (2014).