TOWARDS THE FIRST MEASUREMENT OF PARITY VIOLATION IN CHIRAL MOLECULES NEW ATTEMPTS AND FUTURE PROSPECTIVE

PETER SCHWERDTFEGER, *Centre for Theoretical Chemistry and Physics, The New Zealand Institute for Advanced Study, Massey University Auckland, Auckland, New Zealand.*

Parity violation (PV) effects in atomic transitions have been measured and calculated to high accuracy confirming the so-called standard model in particle physics. The Z-boson exchange between electrons and nucleons leads to a small energy difference between enantiomers of chiral molecules. There is, however, no experimental verification yet of this distinct symmetry breaking effect despite many attempts. Current high-resolution optical spectroscopy experiments carried out in the CO_2 laser frequency range (878-1108 cm-1) in Christian Chardonnets group in Paris achieve resolutions below 1 Hz. Recent calculations in our group applying the standard model show that PV effects in vibrational transitions of chiral methane derivates CFXYZ (X,Y,Z= H, Cl, Br, I) are in the mHz range and below the detection limit. Our research group is therefore searching for better molecules including heavy elements (because of the PV Z^5 scaling with nuclear charge Z) to achieve enhanced PV splittings in the Hz range. New promising candidates are presented in collaboration with the French PV initiative, which aims at a 100 mHz resolution in Ramsay-Fringes experiments using quantum cascade lasers. Another future alternative is single-molecule spectroscopy in traps at ultra-cold temperatures.