

Large Vibrational Parity Violation Effect in Chiral Carbon Tetrahedral Cations

Eduardus^{1,†}

¹Van Swinderen Institute for Particle Physics and Gravity (VSI), University of Groningen, Groningen, The Netherlands

† corresponding author's email: e.eduardus@rug.nl

Currently, there is an ongoing attempt to measure parity violation in chiral molecule using vibration spectroscopy^[1]. This effect is usually small, which made some theoretical predictions to use heavy-metal containing chiral molecule to overcome the detection limit of experimental measurement^{[2][3]}. However, the actualization for these predictions still faces a challenge from experimental synthesis.

Recently, we conducted a theoretical prediction on an isotopically chiral cation, CHDBrI⁺, which yields a promising 1.8 Hz frequency difference in hydrogen wagging vibration^[4]. Further work in this direction shows that cation enhancement also happens in the other vibrations in carbon tetrahedral cations, as shown in Figure 1.

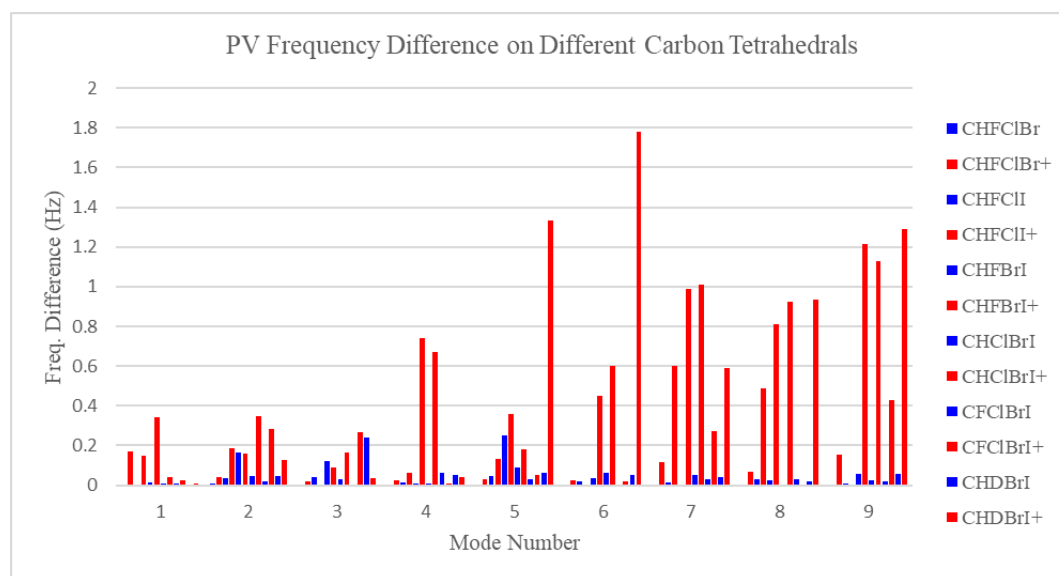


Figure 1: Frequency difference on several carbon tetrahedrals.

References

- [1] A. Landau, Eduardus, D. Behar, E. R. Wallach, L. F. Pašteka, S. Faraji, A. Borschevsky and Y. Shagam, J. Chem. Phys., 2023, 159, 114307.
- [2] N. Saleh, S. Zrig, T. Roisnel, L. Guy, R. Bast, T. Saue, B. Darquie and J. Crassous, Phys. Chem. Chem. Phys., 2013, 15, 10952–10959.
- [3] M. R. Fiechter, P. A. B. Haase, N. Saleh, P. Soulard, B. Tremblay, R. W. A. Havenith, R. G. E. Timmermans, P. Schwerdtfeger, J. Crassous, B. Darquié, L. F. Pašteka, and A. Borschevsky, J. Phys. Chem. Lett. 13, 10011–10017 (2022)
- [4] Eduardus, Y. Shagam, A. Landau, S. Faraji, P. Schwerdtfeger, A. Borschevsky, and L. F. Pašteka, Chem. Commun. 59, 14579–14582 (2023).