NEW PERSPECTIVES ON THE SEARCH FOR A PARITY VIOLATION EFFECT IN CHIRAL MOLECULES

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Parity violation (PV) effects have so far never been observed in chiral molecules. Originating from the weak interaction, PV should lead to frequency differences in the rovibrational spectra of the two enantiomers of a chiral molecule. However the smallness of the effect represents a very difficult experimental challenge. We propose to compare the rovibrational spectra (around 10 μm) of two enantiomers, recorded using the ultra-high resolution spectroscopy technique of Doppler-free two-photon Ramsey interferometry in a supersonic molecular beam. With an alternate beam of left- and right-handed molecules and thanks to our expertise in the control of the absolute frequency of the probe CO_2 lasers, we should reach a fractional sensitivity better around 10^{-15} (a few tens of millihertz), on the frequency difference between enantiomers [a].

We will review our latest results on the high-resolution spectroscopy, either in cell or in a supersonic beam, of methyltrioxorhenium [b], an achiral test molecule from which chiral derivatives fulfilling all the requirements for the PV test have been synthesized [c].

[a] B. Darquié, C. Stoeffler, A. Shelkovnikov, C. Daussy, A. Amy-Klein, C. Chardonnet, S. Zrig, L. Guy, J. Crassous, P. Soulard, P. Asselin, T. R. Huet, P. Schwerdtfeger, R. Bast and T. Saue, Chirality **22**, 870 (2010).

[b] C. Stoeffler, B. Darquié, A. Shelkovnikov, C. Daussy, A. Amy-Klein, C. Chardonnet, L. Guy, J. Crassous, T. R. Huet, P. Soulard and P. Asselin, Phys. Chem. Chem. Phys. **13**, 854 (2011).

[c] N. Saleh, S. Zrig, L. Guy, R. Bast, T. Saue, B. Darquié and J. Crassous, submitted to Phys. Chem. Chem. Phys. (2013).