High Resolution Gigahertz and Terahertz Spectroscopy and Theory of Parity Violation and Tunneling for 1,2-dithiine ($C_4H_4S_2$) as a Candidate for Measuring the Parity Violating Energy Difference between Enantiomers of Chiral Molecules

I. Bolotova[1], S. Albert[1], F. Arn[1], Z. Chen[2], C. Fabri[2], G. Grassi[2], L. Horny[2], P. Lerch[3], M. Quack[2]*

[1]ETH Zurich, [2]Physical Chemistry, ETH Zurich, Vladimir-Prelog-weg 2, 8093 Zurich, Switzerland, [3] Swiss Light Source, PSI Villigen, 5232 Villigen, Switzerland

Electroweak parity violation leads to a slight energy difference between the enantiomers of chiral molecules (on the order of 100 aeV to 1 feV depending on the molecule) and also to a slow time dependent intramolecular process changing parity with time on the order of *ms* to *ks* [1, 2]. Recently we have identi□ed 1,2-dithiine (Figure 1) as a possible candidate for measuring $\Delta_{pv}E$ using the experimental set up described in [3]. Here we report spectroscopic and theoretical studies needed for the preparation of such experiments on 1,2-dithiine ([4, 5] and references therein). We shall also refer to the evolution of the biomolecular homochirality, which may be related to parity violation [6].

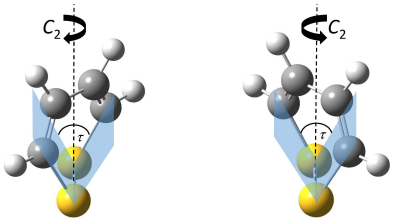

Figure 1. Two enantiomers of 1,2-dithiine ($C_4H_4S_2$), left P, right M enantiomer.

[1] M. Quack Fundamental Symmetries and Symmetry Violations from High-Resolution Spectroscopy, Vol. 1, pp. 659-722 in Handbook of High Resolution Spectroscopy, M. Quack and F. Merkt eds., Wiley Chichester **(2011)**.
[2] M. Quack, J. Stohner, M. Willeke, *Annual Review of Physical Chemistry*, **2008**, 59, 741.
[3] P. Dietiker, E. Miloglyadov, M. Quack, A. Schneider, G. Seyfang,*Journal of Chemical Physics*, **2015**, 143, 244305.
[4] S. Albert, I. Bolotova, Z. Chen, C. Fabri, L. Horny, M. Quack, G. Seyfang, D. Zindel, *Physical Chemistry Chemical Physics*, **2016**, 18, 21976.
[5] S. Albert, F. Arn, I. Bolotova, Z. Chen, C. Fabri, G. Grassi, Ph. Lerch, M. Quack, G. Seyfang, A. Wokaun, D. Zindel, *Journal of Physical Chemistry Letters*, **2016**, 7, 3847.
[6] M. Quack, *Advances in Chemical Physics*, **2014**, 157, 247.

* Further authors are G.Seyfang, A.Wokaun, D.Zindel