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Diffraction effects in the Recoil-Frame Photoelectron Angular Distributions of Halomethanes

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Synopsis We have measured the Recoil Frame - Photoelectron Angular Distributions (RF-PADs) for inner-shell photoionization of CH₃F, CH₃I and CF₃I halomethane molecules for photoelectron energies up to 300 eV detected within a 4π solid angle in the gas-phase. For high kinetic energies, the RF-PADs are dominated by diffraction effects that encode information on the molecular geometry.

Recoil frame - photoelectron angular distributions supply deep insights into the molecular photoionization process and provide access to an unparalleled level of detailed information such as phases of photoelectron waves [1, 2], localization of core holes [3], and double-slit interference [4, 5]. RF-PADs can also be interpreted in terms of photoelectron diffraction [6, 7] and direct information on the geometric and electronic structure of the molecule can be obtained, e.g., by comparing the measured diffraction patterns and RF-PADs to single and multiple scattering calculations [8, 9, 10, 11, 12].

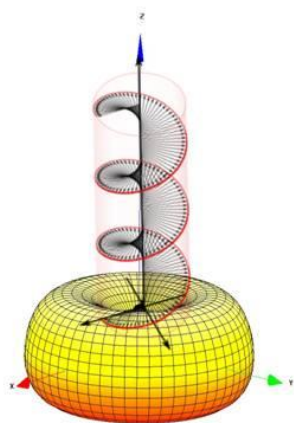


Figure 1: RF-PADs after $F(1s)$ photoionization of CH₃F at 875eV photon energy, i.e. 180eV photoelectron energy. Light propagation axis and molecular F-C axis are parallel.

For high kinetic energies of 50eV and above, the RF-PADs contain diffraction effects that encode information on the molecular geometry in the RF-PADs. In order to illustrate this in more detail, we are comparing our experimental results to single and multiple scattering calculations similar to those used in earlier studies [10, 11, 12] and to DFT calculations [13, 14].

References:

- [1] O. Geßner *et al.*, Phys. Rev. Lett. **88**, 193002
- [2] S. Motoki *et al.*, Phys. Rev. Lett. **88**, 063003
- [3] M. Schöffler *et al.*, Science **320**, 929
- [4] D. Rolles *et al.*, Nature **437**, 711
- [5] D. Akoury *et al.*, Science **318**, 949
- [6] A. Landers *et al.*, Phys. Rev. Lett. **87**, 013002
- [7] B. Zimmermann *et al.*, Nature Phys. **4**, 649
- [8] D. Dill *et al.*, J. Chem. Phys. **65**, 3158
- [9] R. Díez Muiño *et al.*, J. Phys. B **35**, L359
- [10] A.V. Golovin *et al.*, J. Phys. B **38**, L63
- [11] A.V. Golovin *et al.*, J. Phys. B **38**, 3755
- [12] D. Rolles *et al.*, Proc. Of SPIE, Vol. **9198**
- [13] C. Bomme *et al.*, J. Phys. B **45**, 194005
- [14] M. Stener *et al.*, J. Chem. Phys. **140**, 044305

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