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

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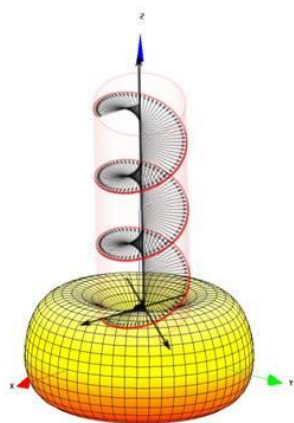
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**Synopsis** We have measured the Recoil Frame - Photoelectron Angular Distributions (RF-PADs) for inner-shell photoionization of CH<sub>3</sub>F, CH<sub>3</sub>I and CF<sub>3</sub>I halomethane molecules for photoelectron energies up to 300 eV detected within a 4 $\pi$  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 CH<sub>3</sub>F at 875 eV photon energy, i.e. 180 eV photoelectron energy. Light propagation axis and molecular F-C axis are parallel.

For high kinetic energies of 50 eV 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].

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