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*"Towards non-linear X-ray spectroscopy with FELs"*

On one hand, many non-linear spectroscopic techniques are well developed in the IR and visible region of the spectrum and can provide a superior understanding of the probed processes. On the other hand, soft X-ray spectroscopy is very informative through their element specificity, chemical selectivity and stringent selection rules. Therefore, the application of non-linear spectroscopic techniques in the soft X-ray region is desired and could provide superior probes for our understanding of materials and dynamics. This development often requires specifically flexible UHV instrumentation and a conceptual understanding of different desired and concurrent processes.

The new MUSIX (multi-dimensional spectroscopy and inelastic scattering station) chamber - currently located at FLASH - is presented, which provides an environment to perform such experiments. Some data on the way towards non-linear spectroscopies is shown and major obstacles, as well as potential pathways around, are discussed.