STUDY OF XFEL PULSE PARAMETERS FOR GENERATION OF COHERENT FEMTOSECOND X-RAY PULSES

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The extension of nonlinear coherent spectroscopies to the hard X-ray regime could be achieved through the creation of intense, phase stable, femtosecond X-ray pulse pairs, thus potentially further revolutionizing studies of chemistry. XFEL pulses are inherently stochastic, structurally and temporally, which is a limiting factor in advancing nonlinear spectroscopy, but stimulated emission generated by XFEL pulses can result in the pulse pairs necessary for this progress. One potential approach to creating these pairs is highlighted in previous work describing the generation of intense, coherent, X-ray pulse pairs on the femtosecond timescale. These pulse pairs were realized based on the observation of spectral fringes that appeared in the X-ray superfluorescence and seed stimulated emission.

The aim of this work is to establish the optimal pump and seed pulse conditions that lend to repeatable generation of femtosecond X-ray pulse pairs. The first step in doing so is to determine the correlation between the parameters of the incoming SASE pulses and the generated pulse pairs. Here we present an overview of the correlation of measured pump pulses and stimulated emission generated from Cu foils, and $MnCl_2$, and $NaMnO_4$ jets.