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The role of transient resonances for ultra-fast imaging[1]
CHRISTOPH BOSTEDT, Ecole Polytechnique Federale de Lausanne and Paul Scherrer Institut, PHAY HO, ANDRE AL HADDAD, MAX BUCHER, GILLES DOUMY, STEPHEN SOUTHWORTH, CHRISTOPHER KNIGHT, LINDA YOUNG, Argonne National Laboratory, TAIS GORKHOVER, PETER WALTER, SLAC National Accelerator Laboratory, BENEDIKT DAURER, JANOS HAJDU, FILIPE MAIA, Uppsala University — Ultrafast imaging with intense short pulses from X-ray free-electron lasers is a promising route to investigate the structure and dynamics of nanoscale systems. The ultrafast imaging process is subject to the sample electronic structure, opening new opportunities to investigate dynamics on the shortest time scales. We have developed a computational approach for describing ultrafast imaging experiments and compare it to benchmark data from succrose clsuters. We find that transient phenomena driven by non-linear x-ray interaction are decisive for ultrafast imaging applications and that transient resonances can be exploited to increase the scattering response and elemental contrast. Our study illuminates the complex interplay of the imaging process with the rapidly changing transient electronic structures in XFEL experiments and shows how computational models allow optimization of the parameters for ultrafast imaging experiments.

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