Ultrashort light pulses as a tool for atomic-scale control of solids

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The long-standing idea of using intense, short light pulses as a means of reversibly controlling the structure of condensed matter systems holds interest from an applications perspective and additionally serves as a fundamental challenge for understanding the strongly out-of-equilibrium properties of materials. Here I discuss several representative examples of light-driven structural excitations that are quantitatively characterized using time-resolved x-ray diffraction, with a perspective on how light-initiated dynamics can both give a better understanding of important interactions in materials and how in the future they might be leveraged into a highly flexible means of materials control.