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Energy-resolved ultrafast charge, spin and orbital dynamics in [Co/Pd] multilayers

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The ultrafast demagnetization is a fundamental problem of modern magnetism, with its microscopic origin remaining intensely debated. Particularly, the role played by the spin-orbit interaction in the moment dissipation to the lattice and that of the exchange interaction in the collapse of long-range order call for measurements capable of resolving the charge, spin and the orbital moment dynamics energy resolved.

Here we use soft X-ray Absorption Spectroscopy (XAS) with femtosecond X-ray produced by the Linac Coherent Light Source (LCLS) to probe charge and band structure dynamics around the Fermi energy E_F in a [Co/Pd] magnetic multilayer. Comparing XAS changes at both L_3 and L_2 absorption edges below and above E_F highlights the role played by the $3d_{5/2}$ states. Using X-ray Magnetic Circular Dichroism (XMCD), we further discuss the spin and orbital moment dynamics with respect to the energy resolved charge dynamics.

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