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Temperature-dependent energy-transfer between electrons and phonons in nickel around Curie temperature and its relation to ultrafast demagnetization[1] XUAN WANG, Florida State University, SHOUHUA NIE, Carnegie Mellon University, JUNJIE LI, RICK CLINITE, JIM CAO, Florida State University, JIM CAO TEAM — We report on the use of Ultrafast Electron Diffraction (UED) to study the ultrafast dynamics of nickel induced by fs-laser excitation. Particularly, we have observed a significant increase of electron-phonon coupling time when the pre-set sample base-temperature is reduced across its Curie temperature. This implies a strong quenching of magnetic ordering (ultrafast demagnetization), which serves as an extra energy reservoir other than lattice to relax the electron energy. By modeling the energy transfer among these three systems, we conclude that ultrafast demagnetization happens in a time-scale even shorter than electron-phonon coupling and one temperature for both electron and magnetic ordering, as suggested by several former studies, works very well from energy point of view. Our results also support the former observed ultrafast demagnetization in itinerant ferromagnets, which happens in sub-ps time scale.

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