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Mapping the Electronic Structure of Warm Dense Nickel via Resonant Inelastic X-ray Scattering[1] SAM VINKO, Department of Physics, University of Oxford, Parks Road, Oxford, OX1 3PU, UK, OLIVER HUMPHRIES, ALAN MISCAMPBELL, QUINCY VAN DE BERG, ORLANDO CIRICOSTA, MUHAMMAD KASIM, RYAN ROYLE, JUSTIN WARK, Clarendon Laboratory, Department of Physics, University of Oxford, Parks Road, Oxford, OX1 3PU, UK, ROBIN MARJORIBANKS, Department of Physics, University of Toronto, 60 St. George Street, Toronto, Ontario, M5S 1A7, Canada, HAE JA LEE, ERIC GALTIER, BOB NAGLER, Linac Coherent Light Source, SLAC National Accelerator Laboratory, 2575 Sand Hill Road, Menlo Park, CA 94025, USA — The exploration of the quantum behaviour of high energy-density systems is a research area of broad importance to applications in plasma physics, astrophysics and fusion energy science. However, measuring the electronic structure in such systems remains a formidable experimental challenge, leading to a dearth of data of sufficient quality for benchmarking theoretical models in extreme plasma conditions. Resonant inelastic x-ray scattering (RIXS) is a popular experimental technique to study low-energy excitations in quantum systems, however, x-ray source requirements have so far limited its use to condensed matter systems. Here we show how the electronic structure of solid-density nickel heated to temperatures of 10s of eV can be mapped via RIXS using the Linac Coherent Light Source free-electron laser at SLAC. We extract single-shot simultaneous measurements of electronic temperature, ionization, ionization potential depression, bound state energies and of the valence density of states. This technique provides a promising approach to observe directly electron relocalization as a function of the plasma environment for the first time.

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