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Isolated attosecond soft X-rays and water window XAFS

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We demonstrate generation of isolated attosecond soft X-ray pulses with duration less than 350 as at the carbon K-edge at 284 eV. This reproducible and CEP stable attosecond soft X-ray continuum covers the entire water window from 200 eV to 550 eV with a flux of 7.3×10^7 photons/s and corresponds to a pulse energy of 2.9 pJ. We demonstrate the utility of our table-top source through soft X-ray near-edge fine-structure spectroscopy at K-shell absorption edges in condensed matter and retrieve the specific absorption features corresponding to the binding orbitals. We believe that these results herald attosecond material science by bridging the gap between ultrafast temporal resolution and element specific probing at the fundamental absorption edges of matter.