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Extreme Ultraviolet Radiation with Coherence Time Beyond 1 second THOMAS ALLISON, Stony Brook University, CRAIG BENKO, ARMAN CINGÖZ, LINQIANG HUA, FRANÇOIS LABAYE, DYLAN YOST, JUN YE, JILA, NIST and the University of Colorado, Boulder — Many atomic and molecular systems of fundamental interest possess resonance frequencies in the extreme ultraviolet (XUV), where laser technology is limited and radiation sources have traditionally lacked long-term phase coherence. Recent breakthroughs in XUV frequency comb technology have demonstrated spectroscopy with resolution at the MHz-level but even higher resolutions are desired for future applications in precision measurement. By characterizing heterodyne beats between two XUV comb sources, we demonstrate the capability for sub-Hz spectral resolution. This corresponds to coherence times >1 s, at photon energies up to 20 eV, more than 6 orders of magnitude longer than previously reported. We also identify various noise contributions to the obtainable comb linewidth in the XUV. This work establishes the ability of creating highly phase stable radiation in the XUV with performance rivaling that of visible light. Further, by direct sampling of the phases of the XUV light originating from high harmonic generation, we demonstrate precise measurements of attosecond strong-field physics.

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