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High average power, high repetition rate table-top soft x-ray lasers for applications in nanoscience and nanotechnology BRENDAN REAGAN, KEITH WERNSING, CORY BAUMGARTEN, LEON DURIVAGE, MARK BERRILL, ALDEN CURTIS, FEDERICO FURCH, BRAD LUTHER, MARK WOOLSTON, DINESH PATEL, CARMEN MENONI, VYACHESLAV SHLYAPTSEV, JORGE ROCCA, Colorado State University — There is great interest in table-top sources of bright coherent soft x-ray radiation for nanoscale applications. We report the demonstration of a compact, high repetition rate soft x-ray laser operating at wavelengths between 10.9nm to 18.9nm, including the generation of 0.15mW average power at λ =18.9nm and 0.1mW average power at λ =13.9nm. These short wavelength lasers were driven by an all diode pumped, chirped pulse amplification laser based on cryogenically-cooled Yb:YAG amplifiers that produces 1 Joule, picosecond duration pulses at 100 Hz repetition rate. Irradiation of solid targets results in the production of plasmas with large transient population inversions on the $4d^1S_0 \rightarrow 4p^1P_1$ transition of Ni-like ions. Optimization of this high repetition rate laser combined with the development of high shot capacity, rotating targets has allowed the uninterrupted operation of this soft x-ray laser for hundreds of thousands of consecutive shots, making it suitable for a number of applications requiring high photon flux at short wavelengths. Work was supported by the NSF ERC for Extreme Ultraviolet Science and Technology using equipment developed under NSF Award MRI-ARRA 09-561, and by the AMOS program of the Office of Basic Energy Sciences, US Department of Energy.

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