Abstract Submitted
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Compact gain–saturated X-ray lasers down to 6.9 nm wavelength and amplification down to at 5.9 nm[1] ALEX ROCKWOOD, Physics Department, Colorado State University, Fort Collins, Co 80525, YONG WANG, SHOUJUN WANG, MARK BERRILL, VYACHESLAV SHLYAPTSEV, JORGE ROCCA, Electrical and Computer Engineering Department, Colorado State University, Fort Collins, Co 80525 — Plasma-based x-ray lasers allow single-shot nano-scale imaging and other experiments requiring a large number of photons per pulse to be conducted in compact facilities. However, compact repetitively fired gain-saturated x-ray lasers have been limited to wavelengths above λ =8.8 nm. We extend their range to λ = 6.89 nm by transient traveling wave excitation of Ni-like ions in a Gd plasma created with an optimized pre-pulse followed by rapid heating with an intense sub-ps pulse. Isolectronic scaling also produced strong lasing at 6.6 nm and 6.1 nm in Ni-like Tb, and amplification at 6.4 nm and 5.89 nm in Ni-like Dy. This scaling to shorter wavelengths was obtained progressively increasing the pump pulse gracing angle. We show that the optimum grazing angle of incidence increases linearly with atomic number from 17 degrees for Z=42 to 43 degrees for Z=66, in agreement with hydrodynamic/atomic physics simulations. The results will enable applications of sub-7 nm lasers at compact facilities.

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