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Compact gain saturated plasma based X-ray lasers down to 6.9nm[1] JORGE ROCCA, Y. WANG, S. WANG, A. ROCKWOOD, M. BERRILL, V. SHLYAPTSEV, Colorado State University — Plasma based soft x-ray amplifiers allow many experiments requiring bright, high energy soft x-ray laser pulses to be conducted in compact facilities. We have extended the wavelength of compact gain saturated x-ray lasers to 6.89 nm in a Ni-like Gd plasma generated by a Ti:Sa laser. Gain saturated laser operation was also obtained at 7.36 nm in Ni-like Sm. Isolectronic scaling and optimization of laser pre-pulse duration allowed us to also observe strong lasing at 6.6nm and 6.1 nm in Ni-like Tb, and amplification at 6.4nm and 5.89 nm in Ni-like Dy. The results were obtained by transient laser heating of solid targets with traveling wave excitation at progressively increased gracing incidence angles. We show that the optimum pump angle of incidence for collisional Ni-like lasers increases linearly with atomic number from Z=42 to Z=66, reaching 43 degrees for Ni-like Dy, in good agreement with hydrodynamic/atomic physics simulations. These results will enable single-shot nano-scale imaging and other application of sub-7 nm lasers to be performed at compact facilities.

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