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Petawatt-class laser operation at 3.3 Hz and high-contrast ultrahigh-intensity λ = 400 nm second-harmonic beamline[1] SHOUJUN WANG, YONG WANG, ALEX ROCKWOOD, BRADLEY LUTHER, REED HOLLINGER, ALDEN CURTIS, CHASE CALVI, CARMEN S. MENONI, JORGE J. ROCCA, Colorado State University, Fort Collins, Colorado 80523, USA — There is great interest in ultra-high intensity laser pulses for relativistic ultrahigh energy density science, ultrashort wavelength coherent and incoherent radiation sources, and particle acceleration. Here we report the demonstration of a Ti:sapphire CPA laser that generates 0.85 PW average peak power, 3.3 Hz, 30 fs pulses with an average power of 85 W. This is the highest average power obtained from a PW class laser. The system is enabled by a frequency-doubled high-energy-flash-lamp-pumped Nd:glass zig-zag slab pump laser designed to operate at repetition rates up to 5 Hz with good beam quality. Pulses containing 80% of the maximum available energy were frequency doubled in a KDP crystal to generate ultra-high contrast λ =400 nm fs pulses that were focused with an f/2 parabola to obtain an intensity of 6.5×10^{21} W/cm^2. Intensities greater than 2×10^{22} W/cm^2 will be obtainable using f/1 focusing optics. This PW-class laser will enable relativistic plasma experiments at high repetition rate and will extend high repetition rate soft x-ray lasers to shorter wavelengths.

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