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An ultrafast optics undergraduate advanced laboratory with a mode-locked fiber laser¹ ANDREW SCHAFFER, CONNOR FREDRICK, CHAD HOYT, Bethel University, JASON JONES, College of Optical Sciences, University of Arizona — We describe an ultrafast optics undergraduate advanced laboratory comprising a mode-locked erbium fiber laser, auto-correlation measurements, and an external, free-space parallel grating dispersion compensation apparatus. The simple design of the stretched pulse laser uses nonlinear polarization rotation mode-locking to produce pulses at a repetition rate of 55 MHz and average power of 5.5 mW. Interferometric and intensity auto-correlation measurements are made using a Michelson interferometer that takes advantage of the two-photon nonlinear response of a common silicon photodiode for the second order correlation between 1550 nm laser pulses. After a pre-amplifier and compression, pulse widths as narrow as 108 fs are measured at 17 mW average power. A detailed parts list includes previously owned and common components used by the telecommunications industry, which may decrease the cost of the lab to within reach of many undergraduate and graduate departments. We also describe progress toward a relatively low-cost optical frequency comb advanced laboratory.

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