Announcing the Final Examination of Joshua Bryan for the degree of Master of Science in Physics

Date: April 1, 2022
Time: 8:30 a.m.
Room: CREOL A214
Dissertation title: Design and fabrication of a compact, rugged, and thermally stabilized fiber based mode locked oscillator with amplification.

Abstract:
High energy ultrashort pulsed lasers can exhibit interesting nonlinear properties during propagation and material interactions. Studying such phenomena is of particular interest to the directed energy community. Generating a high energy ultrashort pulse is done by amplification of an ultrashort seed. This research aims to design and fabricate an all-fiber mode-locked oscillator to serve as such a seed. Use of an all-fiber design allows the development of a self-starting oscillator which is thermally and mechanically insensitive, and can be packaged into a case with a very small footprint. The ability to tailor the output of the oscillator allows the same oscillator design to be compatible with a broad range of systems. Implementing a design which is rugged and compact in nature allows the oscillator to be deployed outside a controlled laboratory environment allowing propagation experimentation to be conducted in real world environments. Presented are the design considerations for building two mode locked oscillators based on a figure of eight design with a nonlinear amplifying loop mirror serving as the fast saturable absorber. Each oscillator outputs a linearly polarized pulse with repetition rates near 10 MHz, and a bandwidth of near 12 nm centered at 1.55 μm. This output is then amplified and tailored to the oscillator's specific end use. One system requires a 1 ps pulse with 2 nm of bandwidth centered at 780 nm. The second system requires a pulse duration of 65 fs with 40 nm of bandwidth at 780 nm.

Outline of Studies:
Major: Physics

Educational Career:
B. S. University of Nebraska, 2007
B. A. University of Nebraska, 2005

Committee in Charge:
Dr. Martin Richardson (Chair)
Dr. Abdelkader Kara
Dr. Steven Fiorino (External Committee Member)

Approved for distribution by Dr. Martin Richardson, Committee Chair, on March 17, 2022
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The public is welcome to attend.