Highly Efficient Systems and Methods for Measuring Ultra-Short Light Pulses

Advantages

• The simple design allows this invention to reduce cost to up to 20 times less than prior art
• The design is much easier to align and requires less input beam power than prior art, resulting in less power needed to split from the main beam in which the power is critical
• It is an automated system requiring little time to process the actual pulse length, resulting in a very effective and easy process

Invention


Background

Ultra-fast laser technology is becoming more commonplace in high-tech industries as new methods are being developed to utilize the characteristics of these lasers. Ultra-fast refers to laser pulses with durations less than a few hundred femtoseconds. Ultra-short pulses have unique advantages in that extremely high energies can be created over ultra-short time scales. These high energies allow access to unique physical processes that only occur at these energies. For most processes the laser irradiance is critical for specific material processing, and in order to qualify the irradiance the exact temporal width must be known. Since these pulses exist for such short time periods there is no direct means of measurement. Therefore, there is a need for efficient, low cost, easy and precise method of measuring ultra-short pulses. Though various approaches to ultra-short pulse measurement are embodied in a number of different commercial devices, these devices have significant shortcomings. One serious shortcoming is that they are unusually difficult to use in practice mostly because they are difficult to align. This lack of functionality is particularly problematic given that frequent system alignment is needed for most light-pulse-measurement applications. Furthermore, the measurement devices are subject to beam-shape limitations, poor quality beam shapes results in poor measurements. In addition, prior art designs are not automated and require significant time to process the actual pulse length, resulting in a very ineffective and hard process. For instance, the person using the device has to record the autocorrelation trace using an oscilloscope, take the data to a computer, format the data and plot it, count the fringes by hand, and then input that number into an equation to back calculate the pulse width. When trying to optimize a laser cavity for short pulses this can take significant time.

The present invention introduces a method for measuring a pulse length of an ultra-short light pulse based on processing a number of substantially similar light pulses. This is an automated system that can be easily used, and its simple design reduces the cost to up to 20 times compared to prior art. The design is much easier to align and requires less input beam power than prior art, resulting in less power needed to split from the main beam in which the power is critical. The systems and methods of the present invention will find great commercial utility in quickly and inexpensively measuring ultra-short light pulses for a variety of scientific and industrial applications that require characterizing an otherwise uncertain output.

Application

The systems and methods of the present invention will find great commercial utility in a variety of scientific and industrial applications.

Lead Inventor

M. Richardson, Ph.D.

Contact: John Miner; University of Central Florida; Office of Research and Commercialization, 12201 Research Parkway, Suite 202, Orlando, FL 32826-3246
Phone: (407) 822-1136; Fax: (407) 882-9010; jminer@mail.ucf.edu; UCF IP # 31002