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White Dwarf and Monaco: A Simple, Turnkey Source of <10 fs Pulses

A compact (30 cm x 30 cm x 24.4 cm) one-box source incorporating an ytterbium-fiber amplifier and a OPCPA provides turnkey access to pulse widths <9 fs with pulse energies >4 μJ and repetition rates up to 5 MHz, featuring excellent long-term (>40 hours) output stability.

Introduction

Ytterbium fiber lasers and (MOPA) amplifiers have emerged as important, new sources of ultrashort pulses that can be scaled to higher average power, with simpler architecture and lower costs, than systems based on Titanium:Sapphire (Ti:Sapphire). These characteristics are proving to be key advantages in applications such as spectroscopy of solid-state materials and advanced techniques in multiphoton microscopy. Unfortunately, ytterbium cannot reach the gain bandwidth of Ti:Sapphire, so these new lasers and amplifiers have typically produced longer pulse widths (100-350 fs) than those achievable from Ti:Sapphire devices. A new type of optical parametric, chirped-pulse amplifier (OPCPA) from Class 5 Photonics has removed this limitation. Incorporating a Coherent Monaco Yb-fiber amplifier and an OPCPA together in a single compact box, the White Dwarf now extends the performance of Yb-based systems into the ultrashort (<9 fs) pulse width regime while retaining all the proven advantages of Yb-fiber lasers. These include MHz repetition rates, high power, excellent output stability, and turnkey performance. This combination is ideal for applications ranging from attosecond physics to ultrafast electron diffraction and multidimensional spectroscopy. Moreover, this flexible OPCPA platform can also be implemented with longer pulse widths and tunable output from UV to NIR.

Monaco: High Power and Fast Repetition Rates

The White Dwarf OPCPA is powered by the Coherent Monaco, a next generation ultrafast amplifier based on ytterbium (Yb) fiber. Ytterbium-doped optical materials have several specific advantages as a gain medium for ultrafast lasers, making them complementary to Ti:Sapphire in scientific applications. Yb has a wide gain bandwidth, enabling mode-locked performance in the femtosecond regime, and in contrast to Ti:Sapphire, ytterbium can be directly pumped by high power laser diodes at a wavelength around 976 nm. And equally important, Yb can be doped in glass fibers.

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White Dwarf and Monaco: A Simple Turnkey Source of <10 fs Pulses

This white paper describes a simple source of ultrashort (<9 femtoseconds) laser pulses: an optical parametric chirped-pulse amplifier (OPCPA) incorporating a high repetition rate ytterbium fiber amplifier – the Coherent Monaco. The integrated one-box OPCPA provides MHz repetition rates, high power, excellent output stability, and turnkey performance. This combination is ideal for applications such as attosecond physics, ultrafast electron diffraction and multidimensional spectroscopy.

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