High efficiency, high energy, CEP-stabilized infrared optical parametric amplifier

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Abstract

A high efficiency, tunable, carrier-envelope-phase (CEP) stabilized near-infrared optical parametric amplifier (OPA) is demonstrated with just a single BBO crystal. A white-light continuum produced by a CEP-stabilized laser is seeded into the two stages of a type II OPA system. We achieved a pump-to-signal conversion efficiency of 34% with a single nonlinear crystal. This work demonstrates a simple and efficient way to produce tunable femtosecond pulses with CEP stabilization.

Motivation

- Nonlinear optics
- Ultrafast spectroscopy
  - Attosecond spectroscopy
  - Isolated attosecond pulses for pump-probe exp.

Schematic of the OPA

Characterizations of the OPA output

- Final amplified pulse profile with superfluorescent amplified signal
- Final amplified pulse profile with perfect time synchronization
- Normalized spectrum change of the OPA by changing BBO phase matching angle

Summary and Future Work

- The total tunable spectral range for the signal pulses is from 1100 nm to 1700 nm.
- The maximum output conversion efficiency from pump to signal in the final OPA stage is 34% at 1350 nm with 138 uJ pulse energy.
- The tunable output pulses are CEP-stabilized by an actively CEP-stabilized seed and pump pulse.
- The two-stage NOPA in the IR that can be applicable to various areas of science such as the two-color field experiment for the generation of IAP.