GENERATION OF BROADBAND COHERENT LASER PULSES BASED ON ADIABATIC FOUR-WAVE MIXING IN WAVEGUIDES AND FIBER (Ramot)

code: 7-2019-1340

Haim SUCHOWSKI , T.A.U Tel Aviv University, Exact Sciences, School of Physics and Astronomy

Efficient and robust frequency conversion of broadband optical pulses is essential for fields ranging from pure science to technology industries, including telecommunications, integrated photonics for the next generation of computers, environmental detection devices, multidimensional and strong-field spectroscopies and generation of new light sources.
In recent years, much effort has been invested in developing schemes to efficiently convert broader and broader optical spectra. Yet the common paradigm of nonlinear frequency conversion with constant phase-matching includes a restrictive tradeoff between the conversion efficiency and its bandwidth.

OUR TECHNOLOGY

Our recent demonstration of the adiabatic frequency conversion concept offered the ability to sidestep efficiency-bandwidth trade-offs in nonlinear frequency conversion. The adiabatic character of the conversion both dramatically increases the available bandwidth in these applications while also ensuring high conversion efficiency. The adiabatic frequency conversion has been implemented in sum-frequency generation (SFG), difference frequency generation (DFG), optical parametric amplification (OPA), and optical parametric oscillation (OPO) for ultrashort pulses or for tunable single-frequency sources.

ADVANTAGES

We further demonstrated adiabatic SFG (A-SFG) with over 92% photon conversion efficiency using an aperiodically adiabatively poled KTP crystal. In the demonstration, a pulse spectrum covering the range between 660 and 990 nm produced by white-light generation is converted by a slowly varying quasi-phase-matching grating in a 20-mm-long KTP crystal to the spectra in the range between 405 and 500 nm, corresponding to a 140 THz bandwidth. To our knowledge, this is the highest efficiency and most broadband photon upconversion reported from a SFG process.

APPLICATIONS

These methods can be extended into the UV using recently invented , novel quasi-phase matching materials.

Contact for more information:

Noam Greenspoon ,

Ramot at Tel Aviv University Ltd. P.O. Box 39296, Tel Aviv 61392 ISRAEL
Phone: +972-3-6406608
Fax: +972-3-6406675