The development of 1-µm-pumped optical parametric sources based on orientation-patterned gallium phosphide

ESR 14: Hanyu Ye

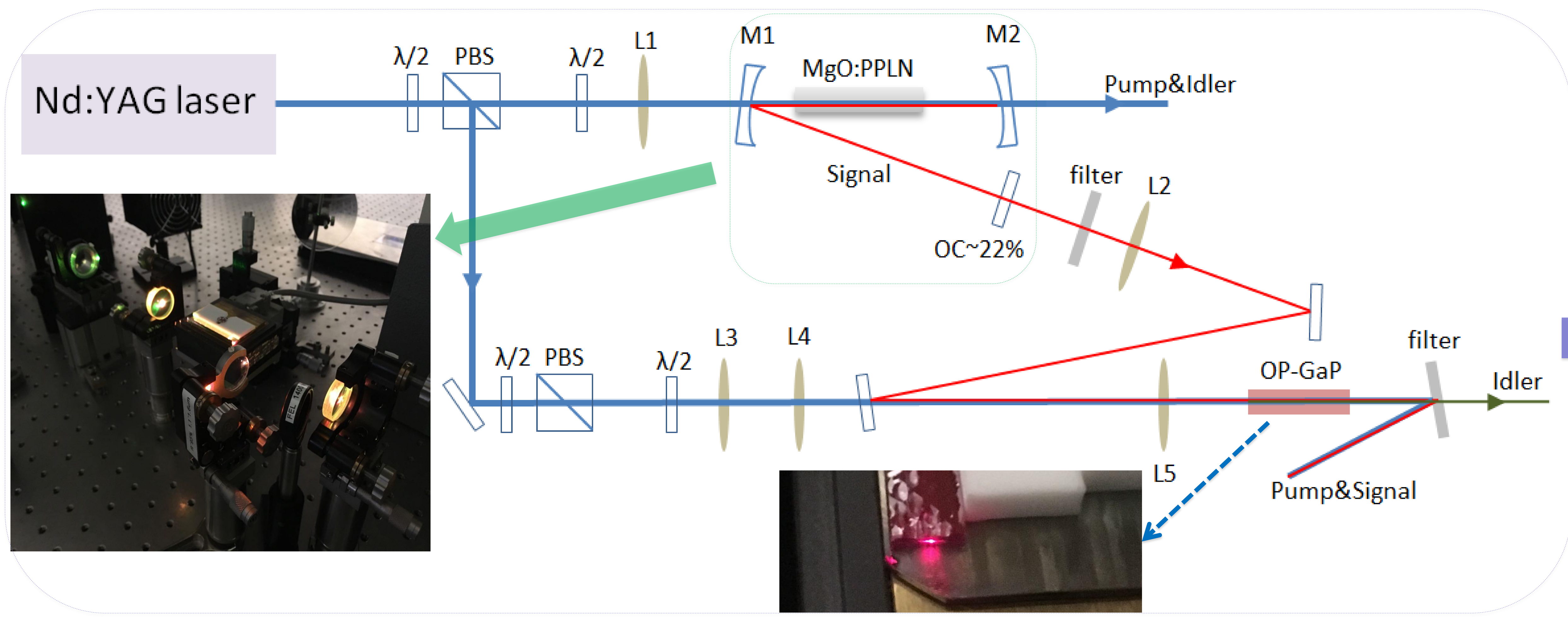
ICFO-The Institute of Photonic Sciences, Barcelona, Spain

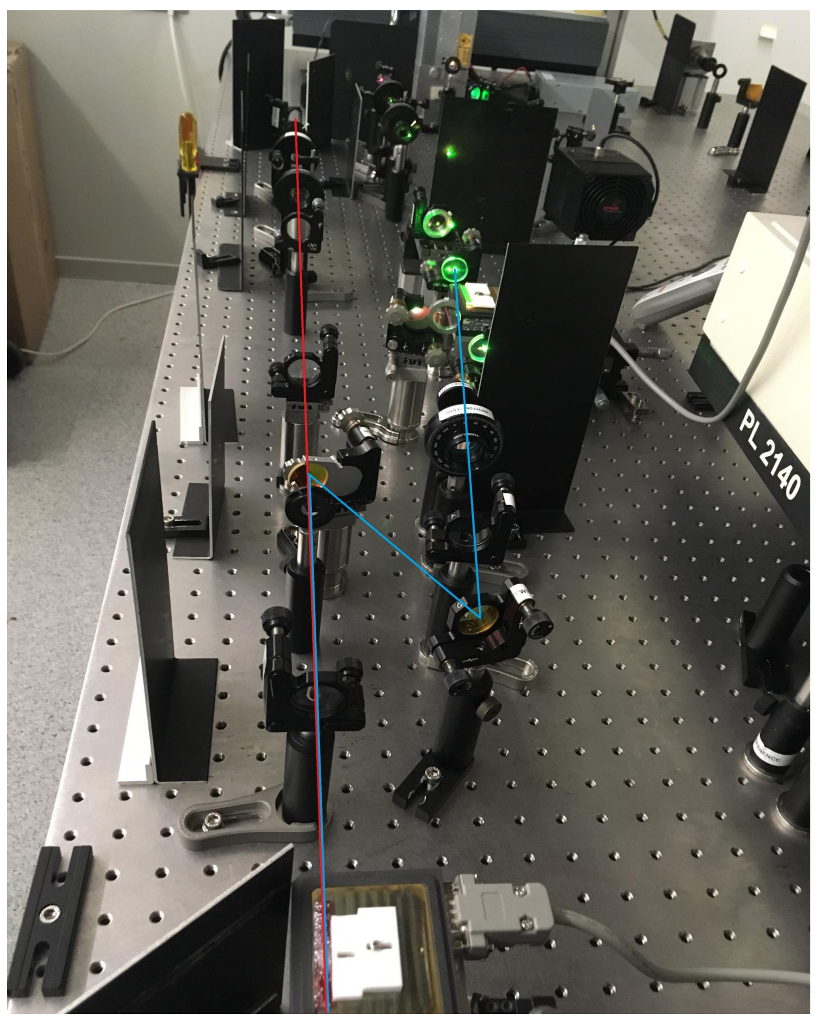
hanyu.ye@icfo.es

Background

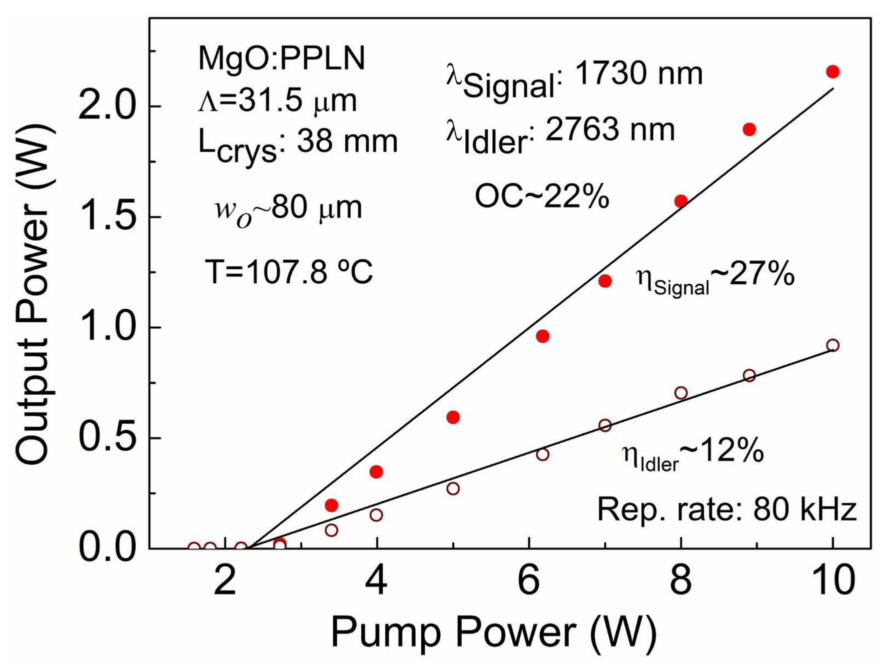
The development of 1-µm-pumped optical parametric oscillators (OPOs) delivering idler wave beyond 4 µm is mainly limited by the transparency range of the nonlinear crystals. The newly emerging nonlinear crystal orientation-patterned gallium phosphide (OP-GaP) is a promising quasi-phase-matched crystal with a high nonlinear coefficient and a wide transparency range in the near- and mid-infrared. Here we report on the first demonstration of tunable pulsed difference-frequency-generation (DFG) in the OP-GaP crystal, which paves the way for the development of 1-µm-pumped OP-GaP OPOs targeting at the deep-infrared region.

Experimental Setup

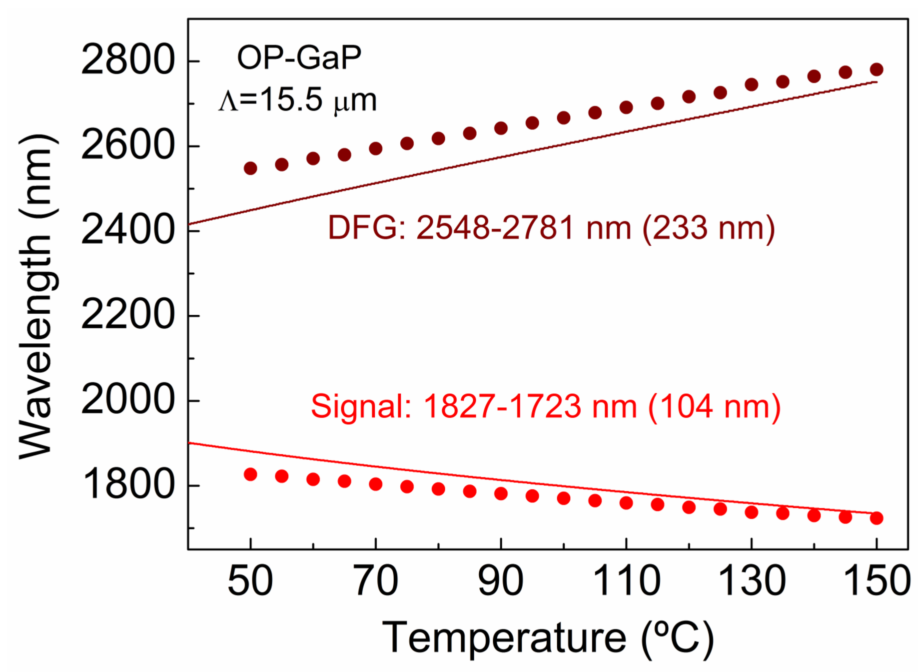




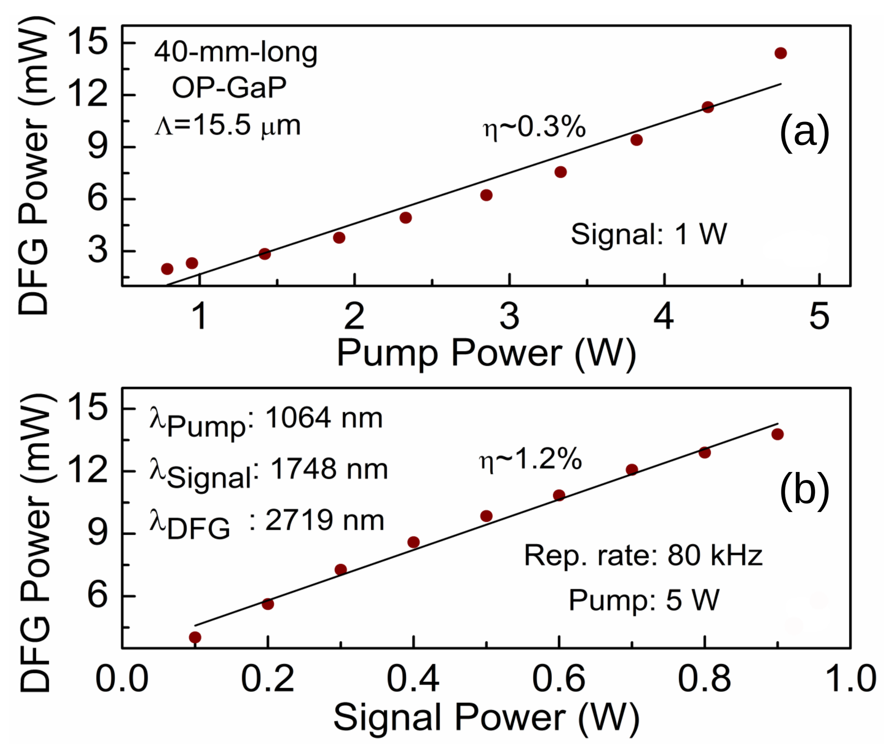
Current Progress



Signal and idler output power as functions of the pump power in MgO:PPLN OPO.

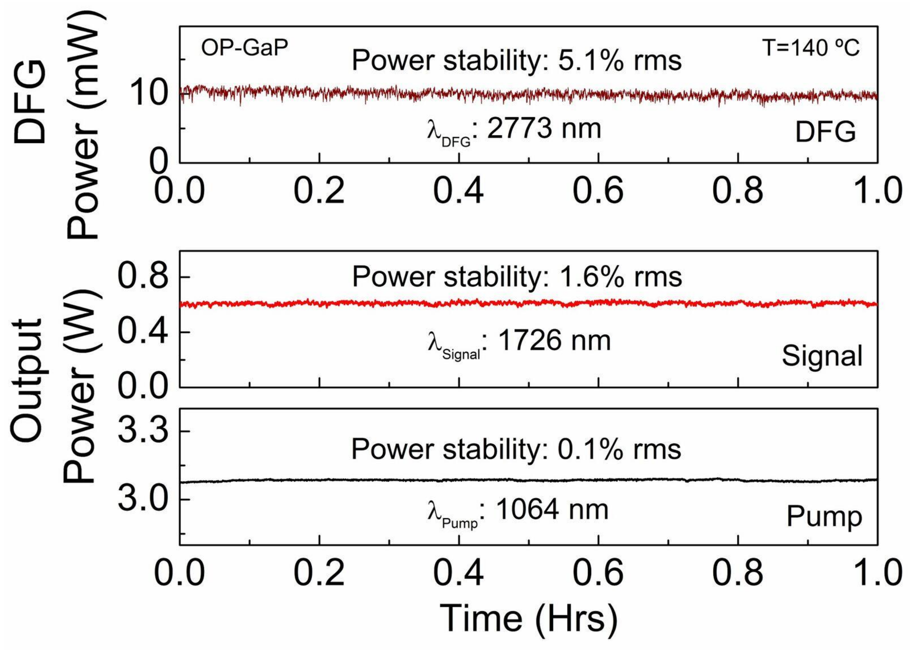


Theoretically calculated and experimentally measured temperature tuning curves of the OP-GaP crystal.

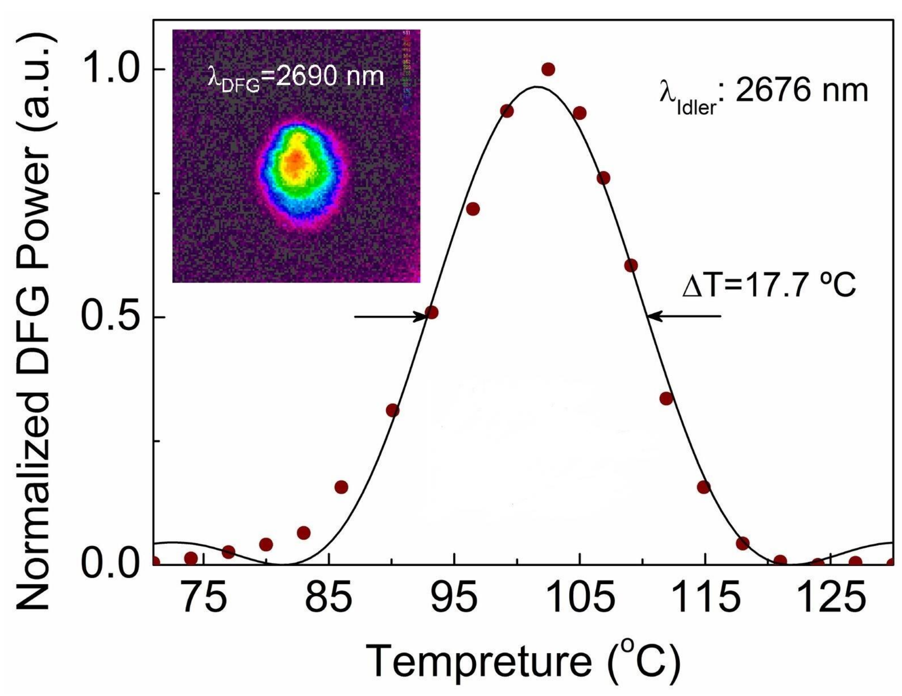


(a) The DFG idler power at 2719 nm as a function of the pump power at 1064 nm when the signal power at 1748 nm is fixed at 1 W with a repetition rate of 80 kHz.

(b) The DFG idler power at 2719 nm as a function of the signal power at 1748 nm when the pump power at 1064 nm is fixed at 5 W with a repetition rate of 80 kHz.



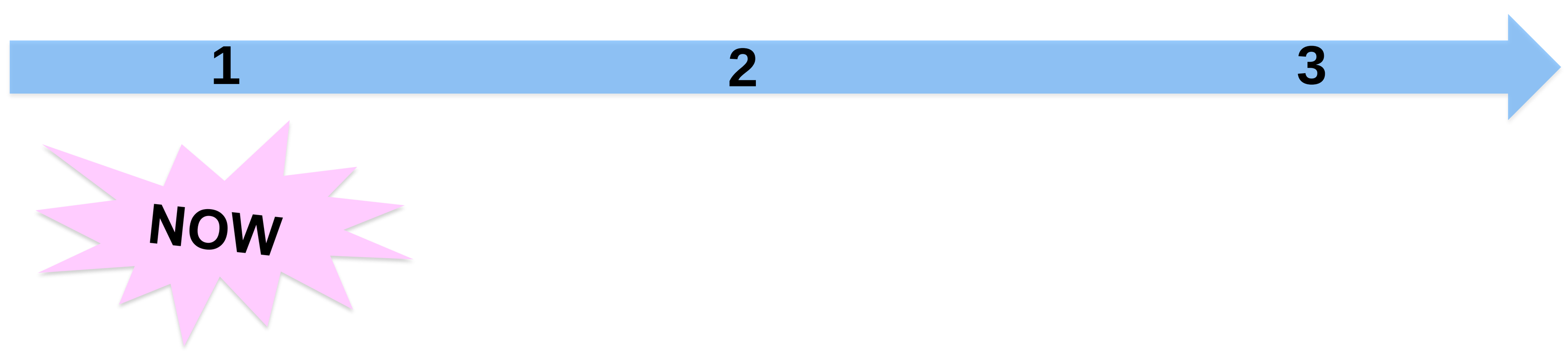
The measured power stability of the DFG idler at 10 mW level and the power stability of the relevant pump and signal.



Experimentally measured temperature acceptance bandwidth of the used OP-GaP crystal.

Development plan

First pulsed DFG demonstration in OP-GaP crystal	Pulsed OP-GaP optical parametric oscillator in the mid-infrared	Extend the output wavelength of OPOs to deep-infrared



Planned Secondments

Mainly for applications of upconversion imaging and spectroscopy

Institution	*Month*	*Duration*
DTU	M26	1 month
DTU	M30	1 month
IRS	M34	1 month

Expected Publications

Pulsed mid-infrared difference-frequency-generation in OP-GaP (*Optics Letters*)

Pulsed mid-infrared optical parametric oscillator based on OP-GaP (*Optics Letters*)

Acknowledgement

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