A NEW, EASY TO USE LIGHT SOURCE FOR CARS MICROSCOPY BASED ON AN OPTICAL PARAMETRIC OSCILLATOR

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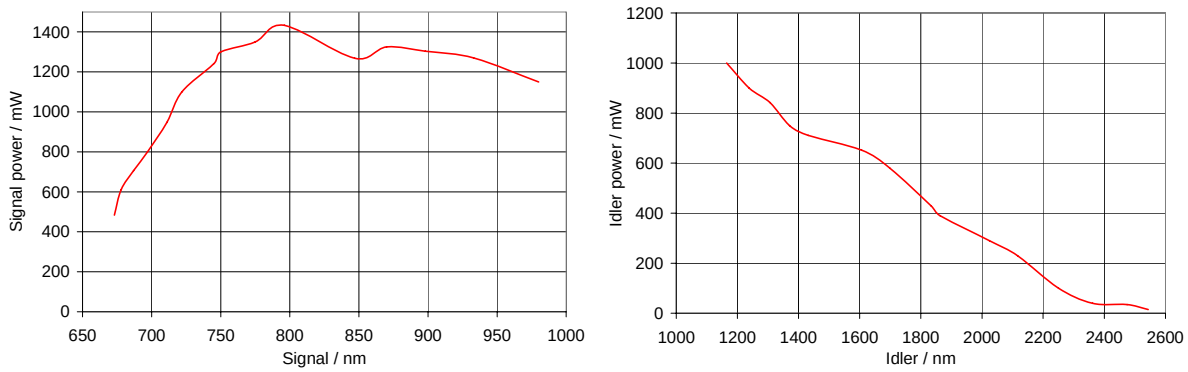
ABSTRACT:
A new, broadly tuneable synchronously pumped picosecond optical parametric oscillator (OPO) for Coherent anti-Stokes Raman Scattering (CARS) microscopy is presented. It is based on a non-critically phase-matched LBO crystal, pumped by the second harmonic (532 nm) of a mode-locked Nd:Vanadate laser [1].
The tuning range covers 680 nm to 990 nm (Signal beam) and 1150 nm to 2450 nm (Idler beam), thus completely substituting picosecond - Ti:Sapphire lasers. By using the Signal and Idler as pump and Stokes beams for CARS microscopy, this translates into a vibrational frequency range of ~1350 - >10.000 cm^{-1}.
Both beams are extracted from the same cavity mirror and therefore propagate collinearly. Due to the mechanism of their generation, Signal and Idler are optically synchronized, and thus, perfectly overlap in space and in time with no jitter.
The 5 ps pulses generated are close to transform limited and of excellent beam quality (M^2 < 1,1) and show a high pointing stability. The output power for Signal and Idler is about 2 W @ 4 W pump power leading to 50% overall conversion efficiency.



Signal and Idler power tuning curves after dichroic separation for 4.5 W pump

The perfect spatial and temporal overlap, stable operation, and broad tuneability makes the described OPO an ideal and nearly hands-free laser source for CARS microscopy. The longer operational wavelength range results in higher penetration depths and lower sample photodamage than previously reported systems. Thus, our CARS source is optimized to image highly heterogeneous tissue samples, as will be shown in several applications.
The latest methods for further sensitivity improvements will be presented.

REFERENCES:

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