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High energy optical parametric source for multi-wavelength CO_2 DIAL

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In the scope of the preparation of spaceborne lidar missions to measure the concentration of greenhouse gases with differential absorption LIDAR techniques, we report on the development of a high energy 2.05 µm optical parametric source based on a versatile architecture enabling multiple wavelengths generation in the vicinity of the R30 absorption line of CO_2. The multi-wavelength configuration is under study for a few greenhouse gas active detection missions, such as Ascend.

The experimental set-up is depicted in Fig.1. It is based on a high energy (tens of mJ) nanosecond Nd:YAG laser used as a pump source for a Master Oscillator Power Amplifier (MOPA) parametric frequency converter. The MOPA configuration enables to reach high pulse energy in the mid-infrared (> 10 mJ at 2.05 µm) while maintaining high spectral and spatial quality [1]. The oscillator is based on a nested cavities doubly resonant optical parametric oscillator (NesCOPO) [2] with a type II PPLN nonlinear crystal. This specific architecture developed at ONERA enables single-mode operation, and the generation of wavelength sequences with adjustable span and resolution. The OPO radiation is then used to seed a type 0 PPLN preamplifier and four KTP amplifiers in order to reach high conversion efficiency.

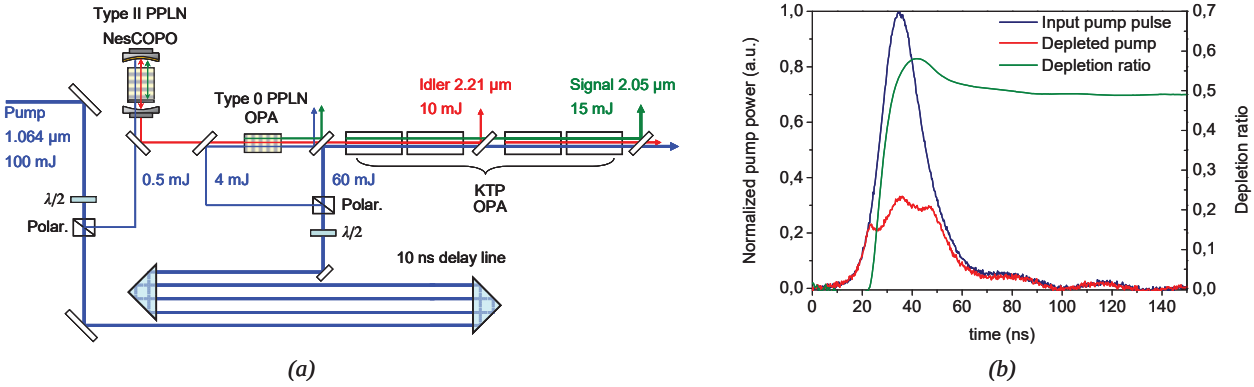

Figure 1: Experimental scheme (a) and conversion efficiency measurement through pump depletion ratio (b).

Fig.1.*(b)* shows a 50 % pump depletion after all the amplification stages, and the extracted signal energy at 2.05 µm was measured to be ~15 mJ, which reaches power requirements for atmospheric DIAL. Further spectral, spatial and power characterizations, as well as specific tuning procedures for lidar applications will be presented.

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