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Optical parametric oscillators: technology and applications

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Generation of tunable radiation in the UV, visible and IR region of the spectrum is of great interest in applications such as medicine, spectroscopy, pollution control or photochemistry. Optical Parametric Oscillators (OPO's) are convenient means of achieving tunable output in solid-state lasers. Progress in the development of OPO's has been slow owing to a lack of suitable nonlinear materials and pump sources of desirable quality. The recent advent of new nonlinear materials such as KTiOPO_4 (KTP), KTiOAsO_4 (KTA), $\beta\text{-BaB}_2\text{O}_4$ (BBO), LiB_3O_5 (LBO) and KNbO_3 or already known crystals with improved quality such as AgGaS_2 , AgGaSe_2 , ZnGeP_2 [1] and LiNbO_3 together with the high beam quality obtained from diode pumped lasers has raised interest in OPO's for the generation of tunable laser radiation.

For example, the recently developed and commercially available BBO optical parametric oscillator can be tuned continuously from 400 nm to 3 μm when pumped at 355nm. The total conversion efficiency from the pump to useful OPO outputs can be well above 30 % at pulsed output energy levels of microjoules to joules depending on the device design and pump source. In the THOMSON group, tunable mid-infrared and far infrared radiations have been produced in the pulsed regime using OPO's in cascade [2]. On another hand an OPO employing KTP as nonlinear crystal was operated as an eyesafe source [3]. In the presentation, we will illustrate the design and performance of state-of-the-art OPO's in combination with recent and future applications.

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