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Single Frequency Intracavity SRO

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Summery

A single resonance optical parametric oscillator (SRO) is inserted intracavity to a CW high power, single frequency, and ring Nd:YVO4 laser. We obtain a stable single frequency CW SRO with output at 1.7-1.9μ (Idler) and a resonating signal at 2.3-2.6μ. The behavior of the two coupled resonators is simulated and the output power from the SRO is described as a function of the diode pumping power supplied to the Nd:YVO4 laser.

The diode pumped Nd:YVO4 laser is made unidirectional by the use of a ring configuration with a Faraday rotator and a half wave plate. The unidirectional operation of the laser is preferred in order to overcome the problem of spatial hole burning and therefore one obtains a single frequency laser. The output power of such a laser is highly stable, due to the steady single frequency operation of the laser, which eliminates the random competition between the longitudinal modes and therefore further stabilizing the output power. We couple out of the laser up to 4 Watt CW output power at a single frequency with satisfactory power stability of (3%). It is the available power for the signal and idler generation. The SRO is operated when all the laser mirrors are highly reflective at 1064nm as in Fig1:

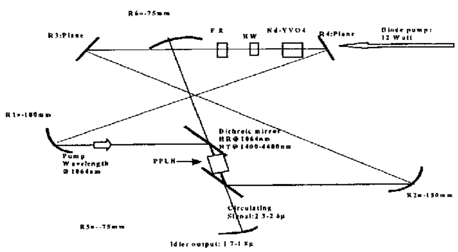

Fig.1: Two coupled cavities, A laser ring and a SRO.

10.15 CMD6

Methods for extending mode-hop-free tuning using a dual-cavity, pump-enhanced optical parametric oscillator

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Continuous-wave (cw) optical parametric oscillators (OPO's) are well suited to high-resolution spectroscopy applications *e.g* [e g 1] Due to their low thresholds there has been interest in using cw OPO's in which two of the interacting fields are resonated in the same cavity (*e g* doubly-resonant OPO's (DRO's) [1] and pump-enhanced singly-resonant OPO's (PE-SRO's) [2]) Common-cavity DRO's have exhibited signal and idler tuning ranges equivalent to several cavity free-spectral-ranges (FSR's), but PE-SRO's are limited by mode-hopping to typically less than one FSR unless the phase-matching is tuned synchronously with pump frequency Further, the idler tuning range is limited in both cases to only a fraction (ν_i/ν_p where ν_i and ν_p are the idler and pump frequencies respectively) of the pump-laser tuning range

We report extended spectral tuning in PPLN based PE-SRO's Coarse wavelength tuning from 2 7 to 5 3μm is possible and smooth single-frequency scanning ranges of over 10GHz are demonstrated The latter is accomplished by a novel dual-cavity configuration in which mode-hopping is suppressed

We also report a further variant of the dual-cavity method in which the signal cavity is scanned synchronously with the pump cavity to 'track' the phase match bandwidth resulting in much larger tuning ranges than in the mode-hop suppression method

Signal wave mode-hopping in the dual-cavity PE-SRO was controlled using an uncoated solid etalon of 115 GHz FSR in the separate arm of the signal cavity The signal field was monitored, as the pump laser was tuned, using a scanning confocal interferometer to check that mode hopping had been eliminated Changes in the idler frequency were observed using a Michelson interferometer of 1 8GHz FSR Figure 1 shows the output of the Michelson interferometer and corresponding change in enhancement cavity length ΔL_p as the pump frequency was tuned repeatedly through 12 3GHz Within this range, we found that the idler frequency could be reliably tuned through 10 8GHz since no mode-hop occurred in the signal field Enhancement of this tuning range using the synchronously tuned signal and pump field method will be discussed.

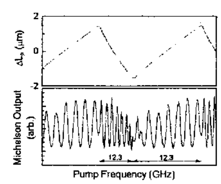

Figure 1 Change in enhancement-cavity length required to maintain resonance, and idler output from the Michelson interferometer, as a function of pump frequency

[1] G M Gibson, M J Padgett, M Ebrahimzadeh and M H Dunn, *Opt. Lett.* **24**, 397 (1999)
[2] G Robertson, M J Padgett and M H Dunn, Opt Lett 19, 1735 (1994)