Second harmonic generation of external cavity tapered diode lasers

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Outline

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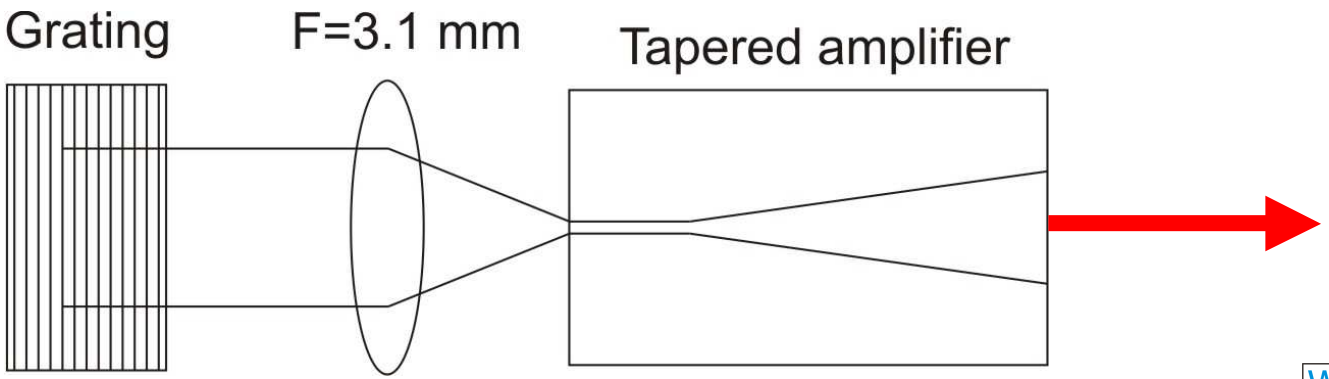
- The external cavity tapered laser - results
- Second harmonic generation - setup
- Second harmonic generation – results
- Summary

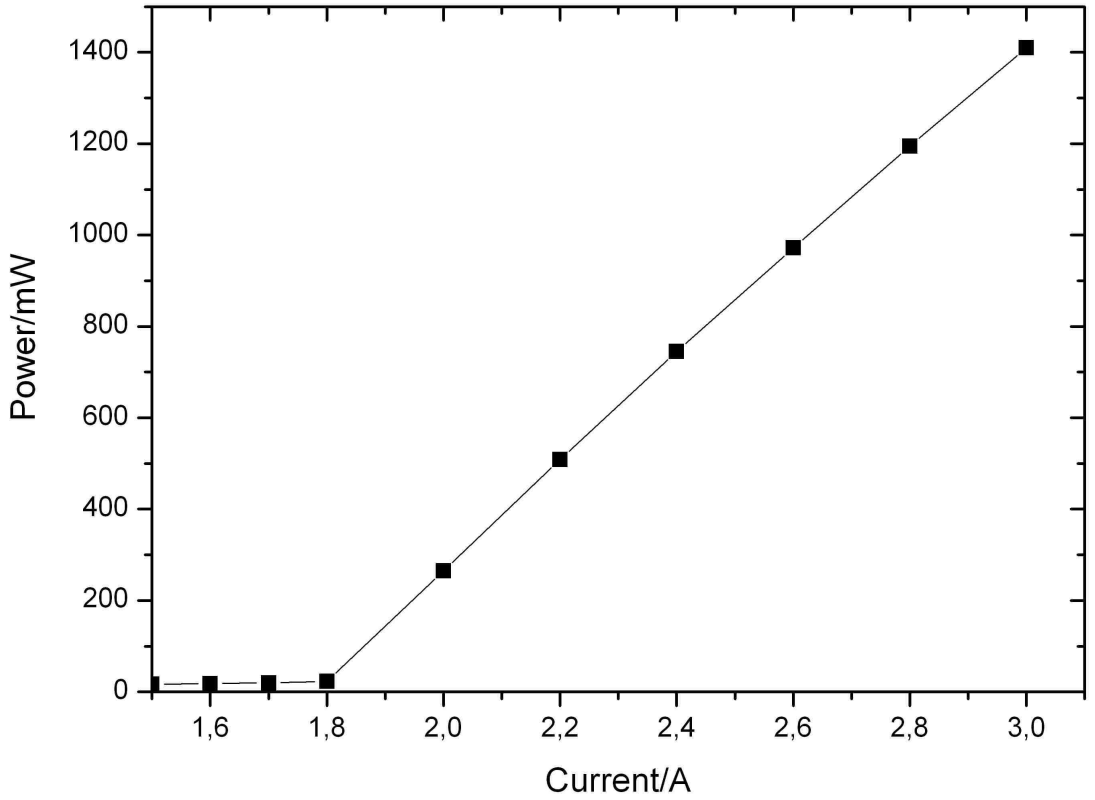
The external cavity tapered laser - setup

- 4 mm long tapered amplifier with 1mm long ridge section and 4º taper angle. GaAsP tensile-strained single quantum well. SLOC structure with a vertical divergence angle of 15º (FWHM). AR coated.
- f = 3.1 mm, NA = 0.68 aspherical collimation lens.
- 1200 grooves/mm blazed grating. λ_{blaze} = 750 nm.
- 15 mm cavity length.
- Temperature stabilized base plate.



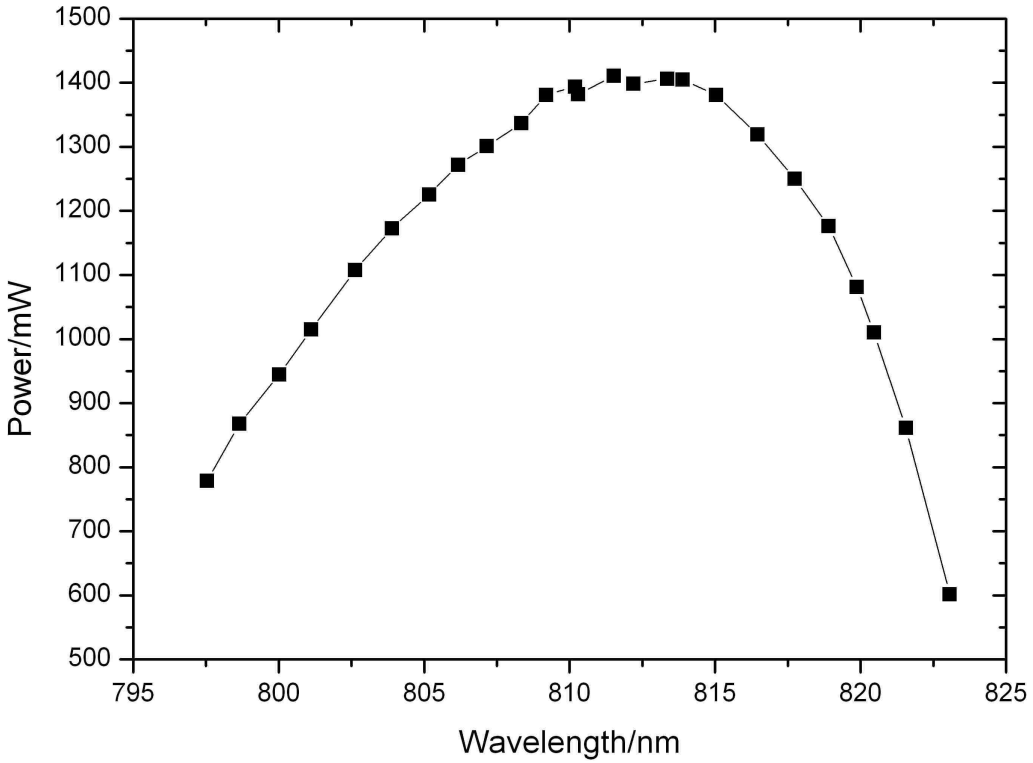
The tapered laser - results

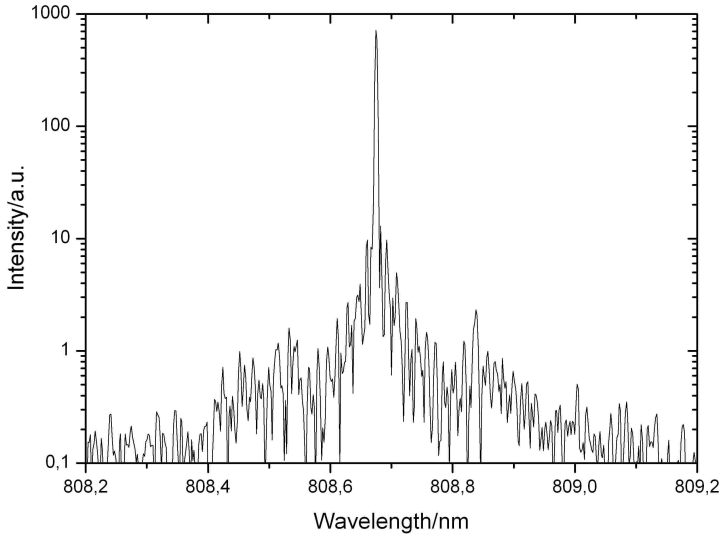
- 1.41 W output power at 3 A.
- Slope = 1.16 W/A
- $M^2 < 1.2$ in both axes.



The tapered laser - results

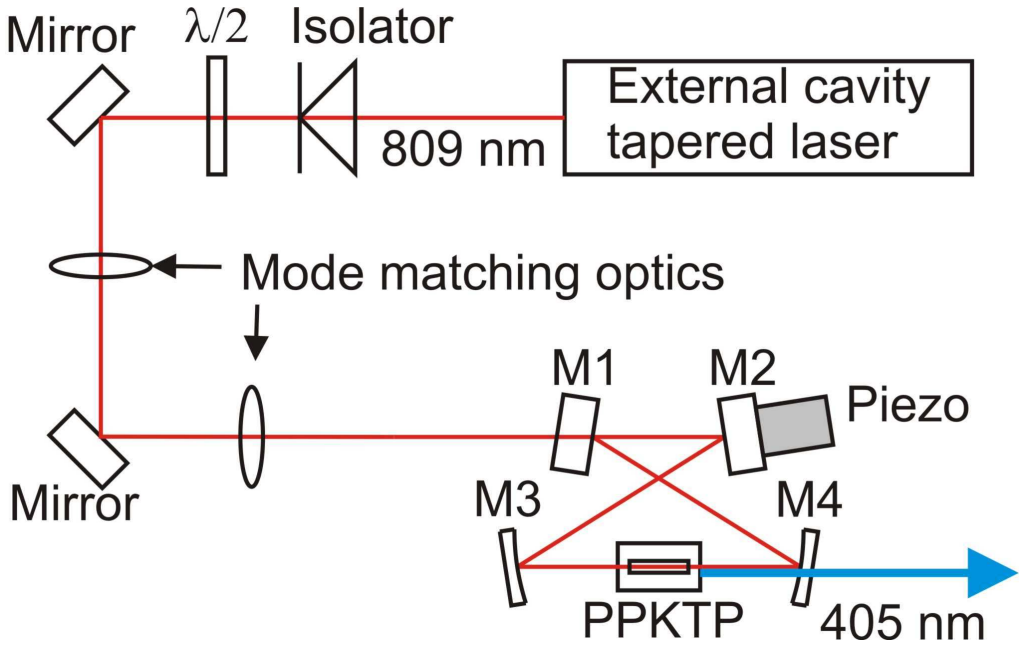
26 nm tuning range (FWHM). Single-frequency over entire tuning range





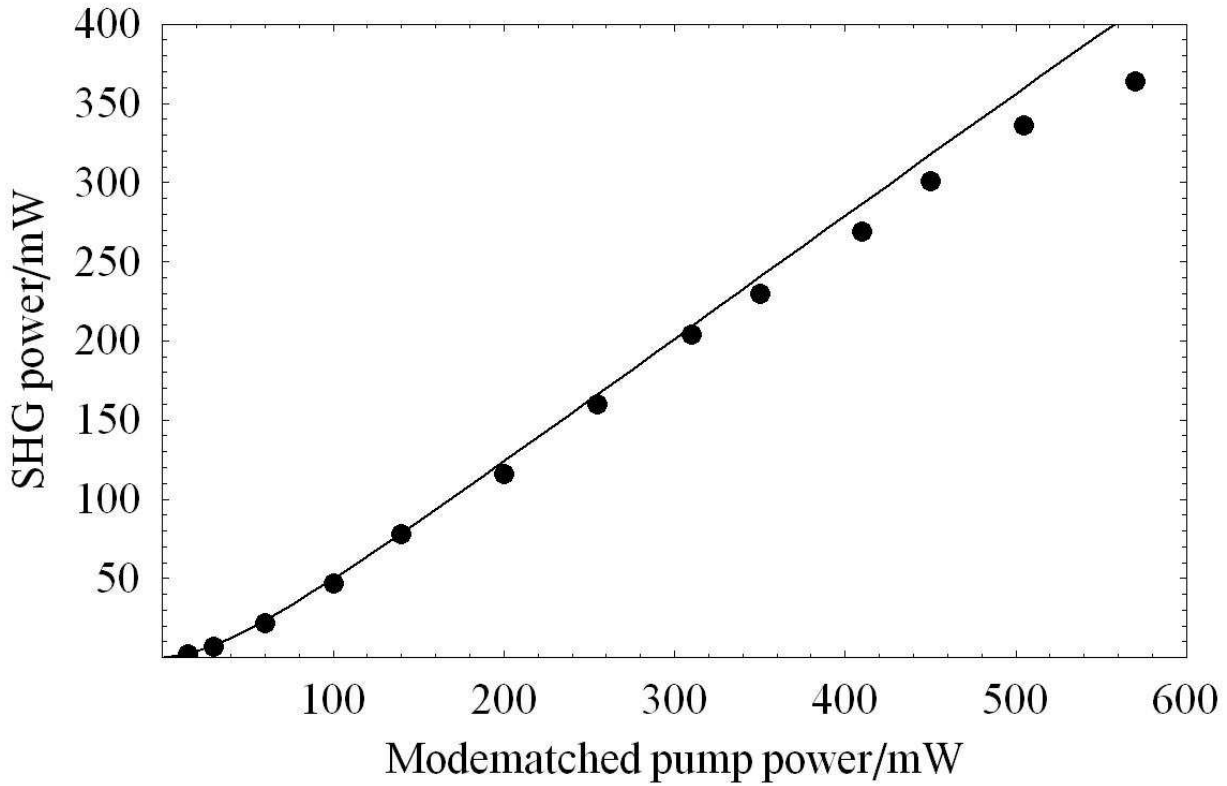
Second harmonic generation - setup

- Isolation between laser and enhancement cavity
- Four-mirror Bowtie resonator
- Nonlinear material is 1 x 2 x 10 mm PPKTP with period of 3.4 µm. AR coated at 810 nm and 405 nm on both facets. Placed in a temperature controlled oven. Beam waist = 42 µm in crystal.



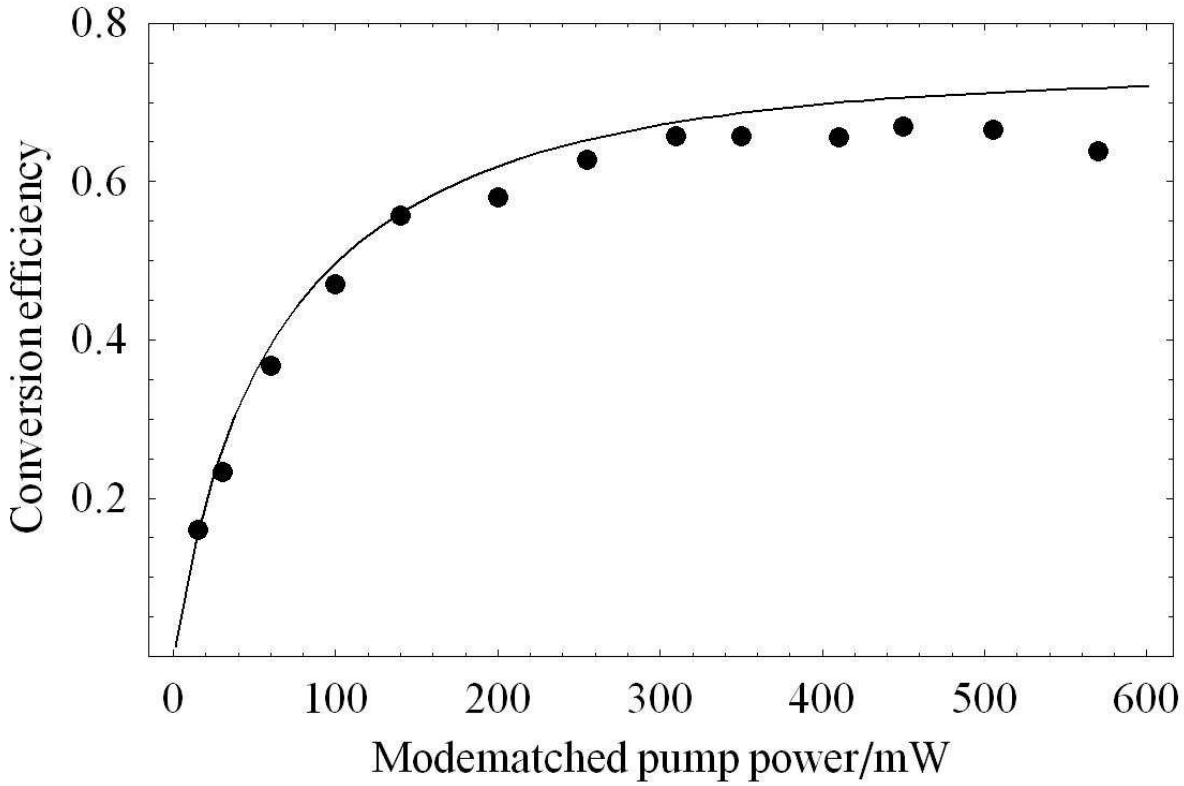
Second harmonic generation - results

- 364 mW of blue light at 405 nm obtained from a coupled fundamental power of 570 mW.



Second harmonic generation - results

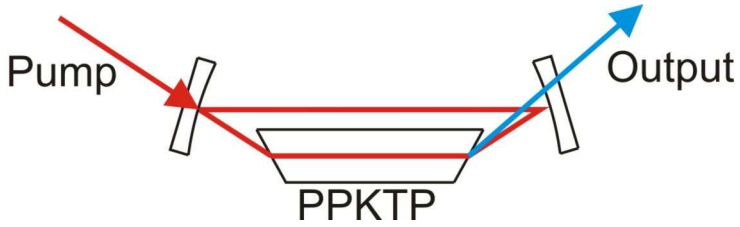
- Up to 67 % conversion efficiency. 64 % at maximum blue power.
- Thermal effects are responsible for the drop in efficiency at high power.

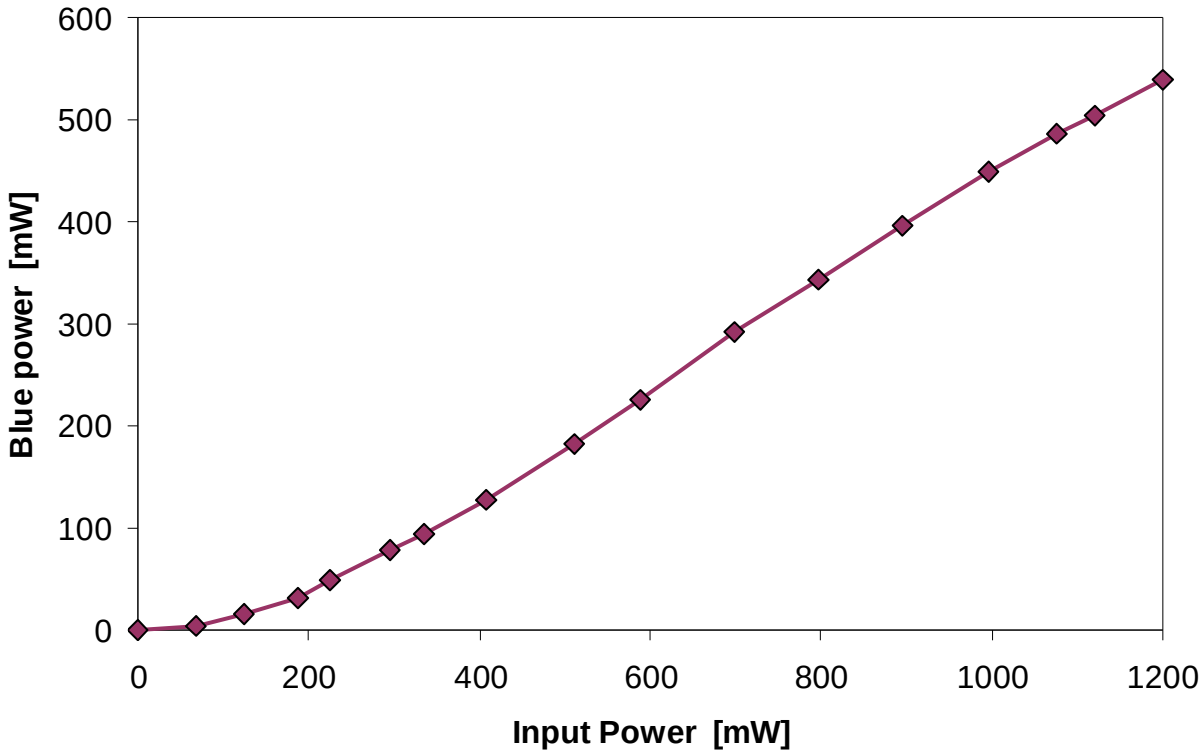


Second harmonic generation - results

New cavity design

Preliminary results





Summary

- External cavity tapered diode laser at 809 nm. Up to 1.4 W tunable single-frequency nearly diffraction-limited output power.
- Second harmonic generation in an external bowtie cavity.
- 364 mW CW blue output power at 405 nm.
- 540 mW blue peak power at 405 nm.
- Up to 67 % conversion efficiency.
- Thermal effects and gray tracking in the PPKTP crystal set an upper limit on the amount of generated blue light.

Acknowledgements

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