# 375-400nm UV Generation via an Alexandrite laser and Zn-indiffused MgO-doped PPLN Waveguides


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Laser sources in the UV-blue region at around 350-400nm are of increasing importance for applications including quantum technologies and material processing. To operate in a wide range of environments, these laser sources need to be compact, robust and have low-power and minimal cooling requirements. The work presented here looks at combining rapid progress in two areas of laser development for addressing these applications. Diode-pumped Alexandrite lasers have become a low-cost and simple approach to achieving multi-watt powers in the near-infrared at around 720-800nm [1]. Zn-indiffused MgO-doped PPLN waveguides have recently demonstrated impressive second harmonic generation (SHG) conversion efficiencies in the near-infrared [2] as well as conversion into the UV with doubling to 390nm recently reported [3]. Here we combine these features.

Fig 1. (a) shows the general experimental setup. The red-diode-pumped Alexandrite laser is a compact plane-plane cavity with a brewster-cut Alexandrite crystal. Wavelength tuning is achieved by angle and temperature tuning (as in [4]) or using an intra-cavity birefringent filter. The laser output is free-space coupled into the PPLN waveguide. Waveguide fabrication is a three-step process, firstly the 5% MgO-doped PPLN wafers are periodically poled, then a zinc layer is deposited and indiffused to form the vertical confinement. Ultra-precision dicing is then used to form the end-facets and the horizontal confinement of the waveguide with ridge widths varying from 5.0µm to 7.0µm. First and third order poling periods of Λ = 2.2µm and Λ = 6.1-6.9µm have been examined for process scalability and SHG at 750-800nm.

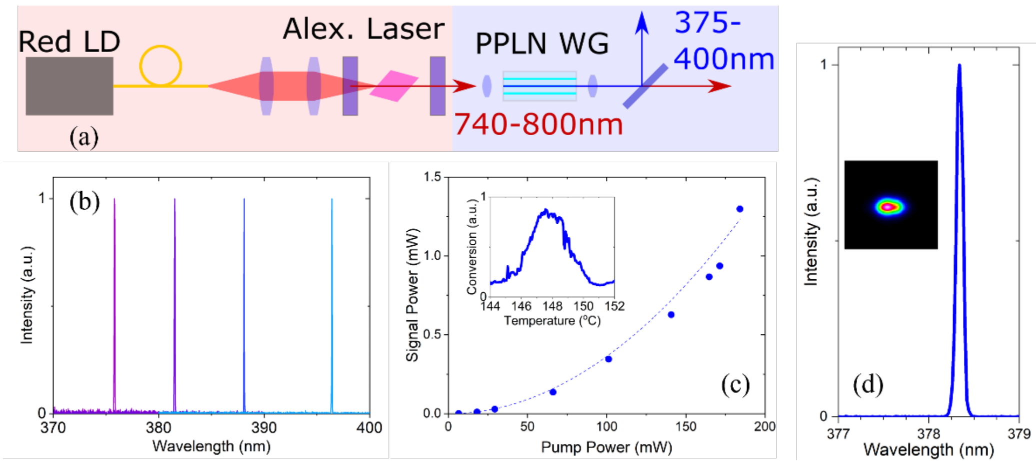


**Fig. 1** (a) UV generation using Alexandrite laser and PPLN waveguide. (b) Spectra of UV generation. (c) Power at 378.3nm as a function of pump power for Λ = 6.1µm PPLN waveguide. (d) 378.3nm spectrum and mode profile.

Tunable laser operation across the 375-400nm band has been achieved with a linewidth of <0.1nm. Fig. 1(c) shows an example of the signal power at 378.3nm as a function of the throughput pump power with around 1.3mW obtained at 185mW pump throughput in a 20mm-long 6.1µm period device – a normalised conversion efficiency of 3.65%/W. Modal analysis is also investigated with the SHG mode shown in Fig. 1(d). This is the first demonstration of a widely tunable UV laser source via SHG of an Alexandrite laser. Our approach enables straightforward, low-cost and compact access to challenging wavelengths. Future work incorporating power scaling, wider wavelength coverage and pulsed operation is envisioned.

## References


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