Tunable Multi-Wavelength Mode-Locking in Nd: YAG Waveguide Laser

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Dual-wavelength lasers are interesting for various applications, such as optical communications, laser location, and THz generation. One of the methods for producing dual-wavelength laser is the use of crystals which provide simultaneous generation at two wavelengths in one ion. Nd: YAG crystal is the most widely used active medium due to its excellent optical and mechanical properties.

In this work, we present the ability to switch between single- and dual-wavelength regimes in a compact diode-pumped Nd: YAG solid-state laser with novel waveguide architecture [1] without increasing the size of the system, as shown in Figure 1. Passive mode-locking is carried out by a graphene-based saturable absorber deposited on the output mirror of the cavity [2]. By controlling the pump parameters, we demonstrate single-, dual- and multi-wavelength mode-locking regimes. In particular, due to fine-tuning of intracavity losses [3] and monitoring of the pump polarization, we achieve a stable CW passive mode-locking at a wavelength of 1064 nm and dual-wavelength mode-locking at 1061 and 1064 nm with a pulse repetition rate of 9.5 GHz. The proposed approach is not limited to the $^4F_{3/2} \rightarrow {}^4I_{11/2}$ transition in Nd: YAG but is also applicable for other energy levels and an active medium having a complicated gain profile.

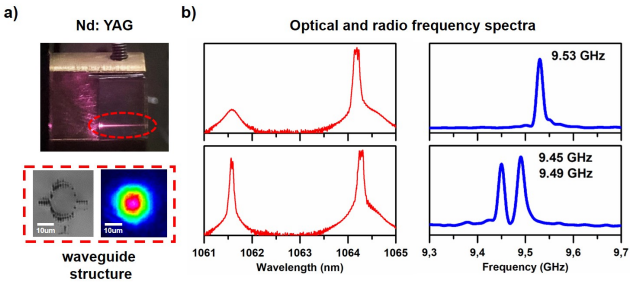

Figure 1: (a) A photo of the waveguide Nd: YAG crystal with a micrograph of the waveguide structure and the intensity distribution of radiation in the waveguide structure; (b) optical and radio frequency spectra obtained at single- and dual-wavelength mode-locking in the waveguide Nd: YAG laser

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References

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