

# Highly Stable and Switchable Dual-Wavelength Single Longitudinal Mode Thulium-Doped Fiber Laser Based on a Saturable Absorber

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**Abstract**— A highly stable, switchable dual-wavelength single-longitudinal-mode thulium-doped fiber laser is proposed and demonstrated. A uniform fiber Bragg grating is employed for wavelength selection, while a saturable absorber formed by thulium-doped fiber achieves single-longitudinal-mode operation. The experimental results show that the optical signal-to-noise ratios of the output lasers at the two wavelengths are 58.66 dB and 71.40 dB, respectively. During 60 min of continuous monitoring, the center wavelength drift remained below 0.03 nm, with peak power fluctuations under 0.602 dB. Across frequencies exceeding 2 MHz, the relative intensity noise of the laser consistently stayed below -123.84 dB/Hz. This wavelength-tunable, highly stable single longitudinal mode fiber laser is expected to be applied in fiber sensing and wavelength division multiplexing systems in the future.

**Keyword**—Thulium-doped fiber laser, wavelength-switchable, single longitudinal mode, saturable absorber, uniform fiber Bragg grating



**Jiancheng Liu** received the Master of Public Administration degree from Beijing Jiaotong University, Beijing, China, in 2023. During his postgraduate studies, he focused on the intersection of public administration and communication engineering, with research interests including communication project policy regulation, telecommunication infrastructure management, and the application of communication technologies in public service scenarios.

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