A miniaturized laser system with short pulse width and high pulse energy for interplanetary laser ranging

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In laser ranging systems, lasers play a great role in the measurement precision and accuracy. To achieve good performance in laser ranging, lasers with short pulse width are highly required. In interplanetary laser ranging, lasers should also meet the requirement of high pulse energy and small M2 so that the photons arriving the detector are above the detectable limit. However, the lasers with specifications that meet the requirement of interplanetary laser ranging generally have large volume, heavy weight, and high power consumption, making them not proper to be used as a payload. In this paper, we developed a miniaturized laser system with a size of 70 mm*30 mm*15 mm and power consumption of ~10 W for interplanetary laser ranging. The laser operates in passively Q-switched mode with the pump process actively controlled. The output pulses have pulse width of ~300 ps, pulse energy of ~300 μJ, pulse repetition rate of 20 Hz, and M2 of ~1.5. The laser offers the shortest pulse width and highest pulse energy among miniaturized lasers to our best knowledge. The laser has great potential in interplanetary laser ranging.