International Conference on

LASERS, OPTICS AND PHOTONICS

July 25-26, 2018 | Osaka, Japan

High-power high-beam-quality 330-nm laser from a frequency-quadrupled Nd:YAG laser

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We demonstrate a high-power high-beam-quality ultraviolet (UV) laser at 330 nm based on fourth-harmonic generation (FHG) of a diode-side-pumped 1319-nm Nd:YAG laser. A 23.2-W Q-switched Nd:YAG laser at 1319 nm with beam quality factor M2=1.15 was employed as the fundamental pump source. First, the output at 1319 nm was frequency doubled to 660 nm in an LBO crystal with an average output power of 11.3 W. Then, the SHG beam was frequency doubled again in another LBO crystal to obtain the FHG output at 330 nm. The maximum average output power at 330 nm was up to 7 W, and the beam quality factor M2 was 1.45 with 1 kHz operation repetition rate and ~53 ns pulse width. A total conversion efficiency was 30.2% from infrared to UV. This is the first 330-nm UV source generation from a diode-side-pumped frequency-quadrupled 1319-nm Nd:YAG laser. The UV 330 nm laser centered at 30, 272.51 cm-1 (λ=330.333 nm) with a linewidth of Δυ=3.5 GHz is suitable to excite the 3S1/2-4 P3/2 sodium transition, which can be applied in producing polychromatic laser guide star to increase the sky coverage using adaptive optics in large telescopes. Moreover, a vacuum UV laser at 165 nm with 6.8 mW was realized by frequency-doubling of the 330 nm laser, which is almost the shortest VUV wavelength through SHG with KBe2BO3F2 (KBBF) crystal. An angle-resolved photoemission spectroscopy (ARPES) with thus higher photon energy (7.52 eV) VUV 165 nm laser may be able to reach larger momentum space and enhanced bulk sensitivity in probing the electronic structure of solids.

Biography

Shen-Jin Zhang received the PhD degree from Xidian University, Xian, China in 2006. He is the deputy director of Key Lab of Function Crystal and Laser Technology, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences. His research interests include nonlinear optics, UV & VUV laser and their applications. He has published more than 25 papers in reputed journals.

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