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Atomic, molecular and optical (AMO) physics require high-power narrow-linewidth tunable lasers at many different wavelengths. Vertical-external-cavity surface-emitting lasers (VECSELs) [1] combine the wide spectral coverage of semiconductor gain media together with the benefits of solid-state disk lasers, in particular power scalability, good beam quality and functionality provided by the external cavity. Thanks to these features, VECSELs have the potential to replace many of the laser systems currently used by AMO and spectroscopy communities [2].

The fundamental wavelength coverage of VECSELs spans almost continuously from around 650 nm to three microns with output powers as high as 100W [3]. The applicable wavelength range can be further expanded to ultraviolet with intracavity and external-cavity frequency-conversion steps. In addition, the external cavity enables the insertion of wavelength selective elements for narrow linewidth operation and wavelength tuning. The use of VECSELs for generation and manipulation of trapped magnesium ions has been recently demonstrated [4] paving the way for use of such system in other scientific applications.

Here we present a ready-to-use, compact, tunable, narrow-linewidth VECSEL prototype operating around 1118nm. The systems delivers 1W output power with 100 kHz linewidth. The prototype platform is prepared for external frequency-locking and the free-space collimated laser output can be externally frequency-quadrupled to 279.6 nm Mg+ Doppler-cooling line. The platform can be extended to other fundamental wavelengths and developments at other wavelength bands will be discussed.

References:

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