

## **A digital laser for on-demand laser modes**

Sandile Ngcobo<sup>1,2</sup>, Igor Litvin<sup>2</sup>, Liesl Burger<sup>2</sup> & Andrew Forbes<sup>1,2</sup>

### **Abstract**

Customizing the output beam shape from a laser invariably involves specialized optical elements in the form of apertures, diffractive optics and free-form mirrors. Such optics require considerable design and fabrication effort and suffer from the further disadvantage of being immutably connected to the selection of a particular spatial mode. Here we overcome these limitations with the first digital laser comprising an electrically addressed reflective phaseonly spatial light modulator as an intra-cavity digitally addressed holographic mirror. The phase and amplitude of the holographic mirror may be controlled simply by writing a computer-generated hologram in the form of a grey-scale image to the device, for on-demand laser modes. We show that we can digitally control the laser modes with ease, and demonstrate real-time switching between spatial modes in an otherwise standard solid-state laser resonator. Our work opens new possibilities for the customizing of laser modes at source.