

# SAIP2013



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## **The digital laser**

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### **Abstract :**

It is well-known how to control the spatial output from a laser, with most solutions to date involving customized intra-cavity elements in the form of apertures, diffractive optics and free-form mirrors. These optical elements require considerable design and fabrication effort and suffer from the further disadvantage of being immutably connected to the selection of a particular spatial mode. Consequently, most laser systems are designed for the ubiquitous Gaussian mode, whereas it is clear that there are many instances when a customised mode would be preferable. We overcome these limitations with the first digital laser, comprising an electrically addressed reflective phase-only spatial light modulator as an intra-cavity holographic mirror. The phase and amplitude of the holographic mirror may be controlled as simply as writing a new gray-scale image (computer generated hologram) to the device: on-demand laser modes. We show that we can digitally control the laser modes with ease, albeit with higher round-trip losses and thus requiring higher gain, and demonstrate the versatility of the technique by switching between several spatial modes in an otherwise standard solid-state laser resonator.

### **Award :**

yes

### **Level :**

PhD

### **Supervisor :**

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### **Paper :**

No

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