

## How to make a digital laser

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### **ABSTRACT**

The beam from a laser resonator is determined by the optical elements it contains. Most commonly, these consist of two spherical mirrors, but phase- and amplitude-modulating elements can also be included to produce custom beams. For every custom beam new optics are required, and the resonator must be realigned, a process which can take several hours to days. The digital laser is an innovation which allows the laser beam produced by a laser to be dynamically controlled by a computer. Essentially, one of the resonator mirrors is replaced by a spatial light modulator (SLM), which is a computer controlled, pixellated, liquid-crystal device. While the concept is the device is simple, the implementation revealed subtle properties of spatial light modulators and the liquid crystals contained in them. These properties had to be well understood before their undesirable characteristics could be overcome, allowing the laser to function as conceived in the design.

**Keywords:** Novel laser, beam shaping, spatial light modulator