液晶空间光调制器：数字化工具下的光场调控

DOI: 10.12086/oee.2024.241010.h03

液晶空间光调制器相对于衍射或干涉元件，可以按照每一个像素快速调控光场，因此受到了广泛的关注，大家已经非常熟练地借助这种新型数字化工具来实现动态的光场调控。

清华大学曹良才教授和南非威特沃特斯兰德大学 Andrew Forbes 教授联合研究团队受邀综述了使用液晶空间光调制器进行光场调控的最新研究进展，并针对这一新兴领域进行了解读和分析。在这篇综述中，他们展示了液晶空间光调制器如何在性能上超越传统的光学元件，并实现了一些新的应用。

研究团队详细分析了液晶空间光调制器的物理特性和工作原理，阐述了其不同的功能，并对液晶空间光调制器进行了启发性的综述，包括从基础知识到前沿应用的不同方面，揭示了液晶空间光调制器推动结构光迅猛发展的物理机制。

他们论述了如何利用液晶空间光调制器完成从精准操控到高效探测不同种类光束的应用，涵盖激光加工、全息显示、光镊光阱、干涉计量、波前编码、光学通信和量子纠缠等领域。液晶空间光调制器不仅推动了这些领域的发展，而且已成为现代量子光学实验室不可或缺的工具。

Opto-Electronic Science, 2023, **2**(8): 230026.
https://www.oejournal.org/article/doi/10.29026/oes.2023.230026.

A review of liquid crystal spatial light modulators devices and applications

DOI: 10.12086/oee.2024.241010.h03

Technology to control and harness light has existed for centuries, often as static solutions that must be custom-designed. It is only in the past couple of decades that the digital era of micro-electronics and computing has seen fast rewritable technology meant for displays find its way into the mainstream of optics.

The research groups of Prof. Liangcai Cao from Tsinghua University and Prof. Andrew Forbes from University of the Witwatersrand review the recent progress in using a modern digital toolkit for on-demand forms of sculptured light, offering new insights and perspectives on this nascent topic. The core technology that has advanced this field is the liquid crystal spatial light modulator (SLM), allowing high resolution tailoring of light in amplitude, phase, polarisation, or even more exotic degrees of freedom such as path, orbital angular momentum, and even spatiotemporal control. These simple yet highly effective devices are made up of millions of pixels that can be modulated in phase, for spatial control of light in an in-principle lossless manner. In this review, the authors show how such SLMs can be exploited for a myriad of tasks, from creating all forms of structured light to fast and efficient detectors. They have fueled advances in optical communication, microscopy, imaging and have even become indispensable in modern quantum optics laboratories. It has brought the highly technical and difficult field of diffractive optics and digital holography very much into the mainstream, for anyone to access with relatively cheap solutions.

The authors unpack the mechanics of how SLMs work, provide novel insights and perspectives based on their long track record in the topic, revealing how this new field is rapidly accelerating along with the nascent topic of structured light. They suggest what the future may hold when present challenges are transformed into exciting applications.

Opto-Electronic Science, 2023, **2**(8): 230026.
https://www.oejournal.org/article/doi/10.29026/oes.2023.230026.