亮点报道：液晶集成的超构表面，实现构建新型有源光子平台

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超构表面是一种人工构造的亚波长纳米结构表面，可实现对入射光相位、振幅、透射、反射等物理参量的精确调控，因此被誉为“驭光者”。由于超构表面有望取代诸多传统光学元件，并能够创造全新功能及拓展视场角、提升分辨率等，从而彻底改变了光学领域的面貌，对显示、传感、增强/虚拟现实 (AR/VR)、光探测和测距等领域具有重要意义。

基于多年在液晶、超构表面集成方向的深入研究，来自韩国浦项科技大学的 Junsuk Rho 教授团队详细阐述了向列型、近晶型、柱状和胆甾型等不同类型液晶的优缺点；介绍了液晶集成的超构表面在全息、光学透镜、光束转向、透射/反射调制和吸收器等方面的应用现状，并讨论了其在 AR/VR、加密和传感器等前沿技术中的潜在应用。超构表面可以与向列型、近晶型、柱状和胆甾型等不同种类的液晶集成来赋予超构表面可调性，进而实现其在虚拟/增强现实 (VR/AR)、加密和传感器等方面的应用。

研究团队还深入讨论了液晶集成的超构表面目前所面临的挑战，并对其未来发展方向进行了展望。该综述为基于液晶和超构表面集成的新型有源光子平台的发展应用奠定了基础。

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Highlights: Liquid crystal-integrated metasurfaces for an active photonic platform

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Conventional metasurfaces face a fundamental limitation-their static nature impedes dynamic responses, akin to stationary structures devoid of adaptability. Addressing this limitation has led to the conceptualization of an "active photonic platform", aiming to impart metasurfaces with dynamic responsiveness.

Rho's research group investigated the synergistic integration of liquid crystals with metasurfaces. The exploration commenced with a meticulous analysis of the advantages and disadvantages of liquid crystals, including a comparative examination of different types such as nematic, smectic, columnar, and cholesteric liquid crystals. Subsequently, the study delved into recent advancements, elucidating how liquid crystals, when integrated with metasurfaces, contribute to functionalities such as hologram, lens, beam steering, transmissive/reflective modulation, and absorber. The exploration extended to potential applications in cutting-edge technologies like AR/VR, encryption, and sensors.

This paper serves as a comprehensive exploration of the collaborative integration of liquid crystals with metasurfaces, shedding light on the scientific intricacies that underpin this advanced optical technology. The integration of liquid crystals with metasurfaces presents a promising avenue for the development of dynamic optical systems, paving the way for transformative applications in various technological domains.

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