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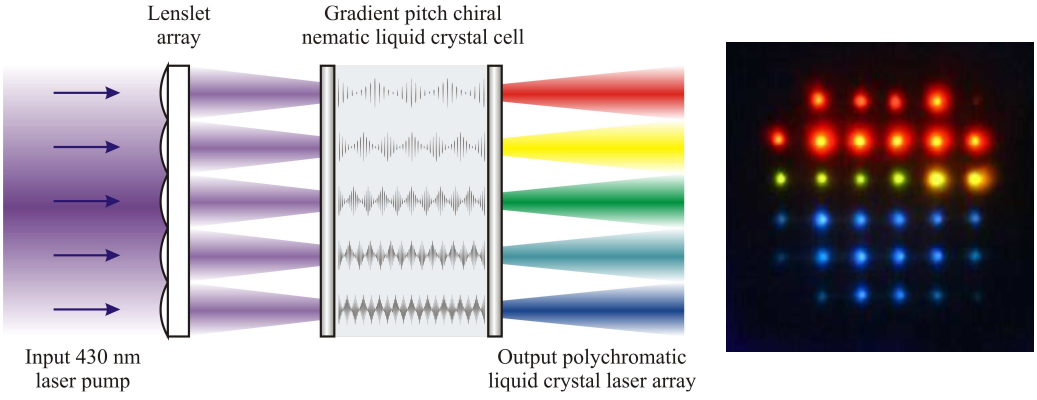
Liquid crystal lasers offer tunability and high slope efficiencies within a cheap and highly compact device architecture. In this paper, we demonstrate how a band-edge liquid crystal laser, pumped by a single optical source at 430nm, can be made to produce an array of simultaneous polychromatic laser outputs [1].

To produce a liquid crystal (LC) laser, a laser dye (the gain medium) is combined with a chiral nematic host (the feedback structure). When the system is optically pumped by an array of spots from a single pulsed laser [2], a type of distributed feedback laser can be produced, the emission wavelength of which can be controlled through adjustment of the pitch of the chiral nematic.

In this paper, we fabricate three different LC laser mixtures, each of which absorbs light in a similar region of the spectrum, around 430nm, but emits in the red, green and blue regions respectively. Separate red, green and blue lasers can therefore be produced. Compartmentalised cells were made, offering three simultaneous laser emissions from a single device, utilising a single pump source. Finally, gradient pitch cells were made by diffusing together the red and the blue laser mixtures within a single cell. This gives rise to polychromatic emission across the full visible spectrum in different regions of the cell.

Polychromatic LC lasers could be used to replace individual red, green, blue lasers that are currently required in emerging laser displays. This would facilitate a reduction in the fabrication and materials cost. Furthermore, liquid crystal lasers are less likely to suffer from problems such as speckle, which are commonly associated with conventional laser display systems.



[1] S.M. Morris, P.J.W. Hands, S. Findeisen-Tandel, R.H. Cole, T.D. Wilkinson, H.J. Coles, Optics Express, **16** (23), 18827-18837, (2008).
[2] P.J.W. Hands, S.M. Morris, T.D. Wilkinson, H.J. Coles, Optics Letters, **33** (5), 515-517, (2008).