Sillenites Ltd.

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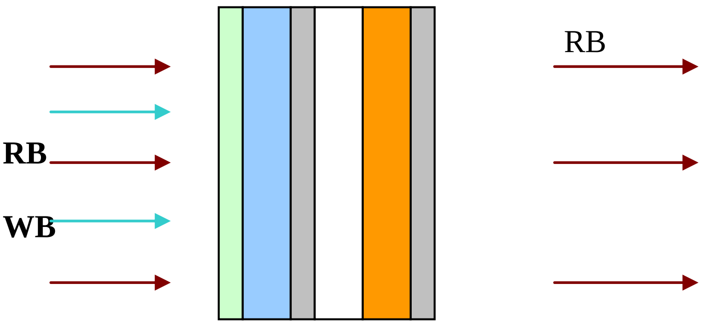
Optically Addressed Spatial Light Modulators

Liquid Crystal Light Valve – LCLV



AR / GL / ITO /LC/ CRYSTAL / ITO

AR – antireflection coating, **GL** – glass substrate, **ITO** – transparent electrodes
LC – liquid crystal, **CRYSTAL – BSO ($Bi_{12}SiO_{20}$), BGO ($Bi_{12}GeO_{20}$)** photoconductive crystal, **RB** – reading beam, **WR** – writing beam

Principle operating

The **LCLV** is an optically-addressed spatial light modulator (**OASLM**) using bulk **BSO ($Bi_{12}SiO_{20}$) or BGO ($Bi_{12}GeO_{20}$)** crystal plate as the photoconductive substrate for **WB** and liquid crystal (**LC**) layer like a light modulation material for **RB**. The principle of operation of **LCLV** is as follows: when **WB** is projected onto the **CRYSTAL**, it reduces the photoconductor impedance, so that the voltage applied to the cell via two transparent electrodes **ITO** is transferred to **LC** layer. The resulting molecular reorientation induced by the electric field locally modifies the **LC** refractive index and therefore spatially modulates the amplitude or the phase of **RB**. The conductivity of the **BSO or BGO** crystal varies linearly with the incident **WB** intensity thus inducing a proportional change of the amplitude (or the phase) of the **RB**. The wavelength of the **WB** projected onto **LCLV** should correspond to the spectral sensitivity range of the photoconductor **BSO or BGO** while for **RB**, the laser wavelength and intensity should not have effect on the photoconductor. The resolution of **LCLV** is a function of respective thickness of **LC** and **BSO** crystal. Typical spatial resolution values for **BSO ($Bi_{12}SiO_{20}$) or BGO ($Bi_{12}GeO_{20}$)** 1 mm thickness are approximately equal to the **LC** thickness 10 – 100 μm. The LCLV acts like as a phase plate whose phase profile can be altered in real time.

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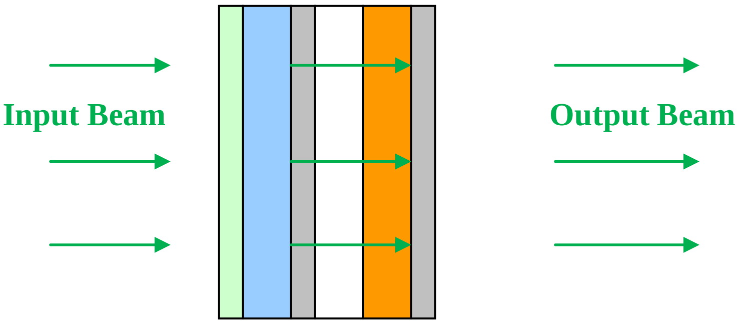
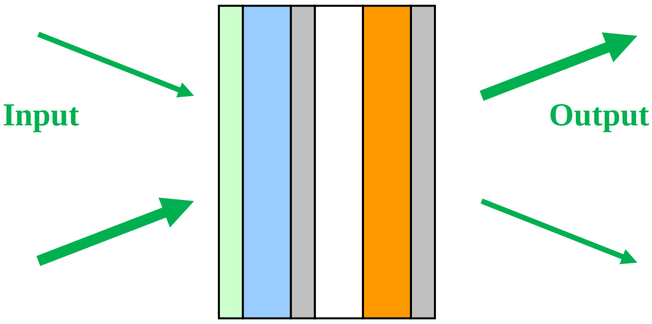


If wavelength of **WB** (**Input Beam**) is equal to wavelength of **RB** (**Output Beam**) together with transparency of **LCLV** and photosensitivity of **CRYSTAL** at this select wavelength (for example, wavelength 514, 532 nm for photorefractive **BSO or BGO crystal** and 1064, 1550 nm for semiconductor **SI-GaAs**), then such type of **LCLV** operates like Kerr-like medium and open numerous nonlinear applications: laser beam manipulation, coherent image amplification, two wave-mixing (**TWM**), slow-light.



High **TWM** gain was achieved with a few tens of µW/cm2 optical intensity at 514 nm in **LCLV** with **BSO** photoconductor. Dynamic grating recording was achieved in the near infrared range by using **LCLV** operating in the transmission mode at 1064 nm wavelength whereas adaptive holography has been demonstrated by using **LCLV** working at 1550 nm.

References

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