Sillenites Ltd.

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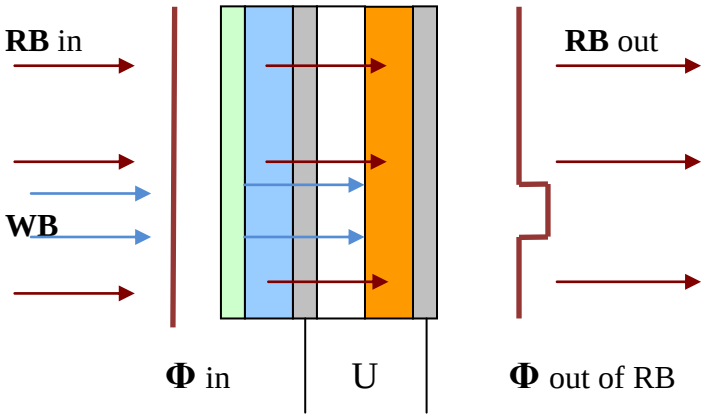
Optically Addressed Spatial Light Modulators

Optically Addressed Light Valve – OALV (OA LCLV)



AR / GL / ITO//LC/ / PC / ITO

AR – antireflection coating, **GL** – glass substrate, **ITO** – transparent electrodes **LC** – parallel aligned liquid crystal unit, **PC** photoconductive crystal **– BSO ($Bi_{12}SiO_{20}$), BGO ($Bi_{12}GeO_{20}$)** crystal, **WB** – incoherent writing beam, **RB** – coherent reading beam,

Principle operating

The OALV is an optically-addressed liquid crystal light valve (or OA LCLV) using bulk BSO or BGO crystal plate as the photoconductive substrate for WB and liquid crystal, LC layer as electro-optical modulation medium for RB. Optical structure of OALV is the same like structure of LCLV devices, which are OASLM optical devices based on liquid crystal technology. The OALV consists of liquid crystal cell between crystal (BSO, BGO) and glass substrates, both substrates are with ITO electrodes on one side. Voltage (U) is applied between LC and PC layers by transparent ITO electrodes. If liquid crystal is parallel aligned nematic, then OALV is operating as spatial phase shaper (phase only modulation), transferring addressed incoherent WB intensity modulation to phase modulation of coherent RB. The OALV devices are successfully applied in laser systems with opto-electronic feed-back loop between the output wavefront sensor and the OALV correction of spatial phase of short laser pulses. Depending on output shape of phase of laser system, an adaptive phase plate will be generated by optically driving the OALV.

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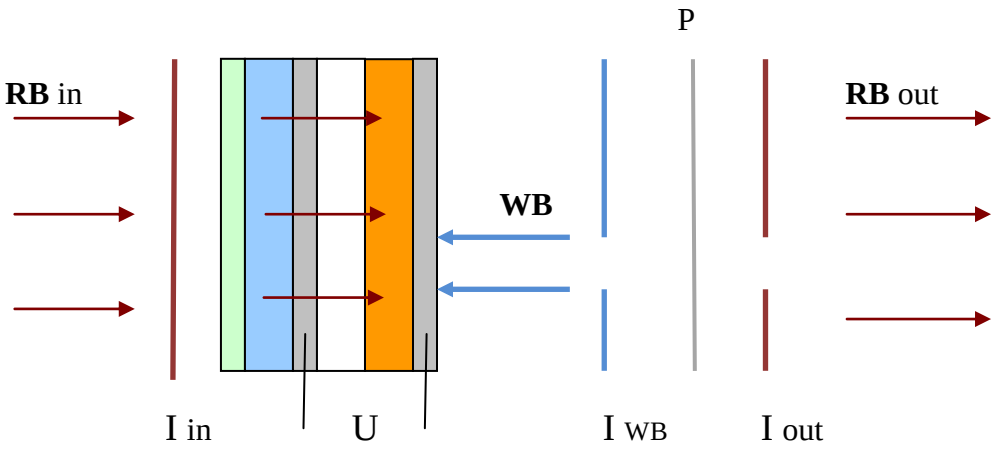
In case of using twisted aligned nematic liquid crystal, amplitude of RB is modulated by addressing WB. Such OALV rotates the plane of RB polarization in dependence on optically addressed intensity of WB image. Image of WB is projected (by EASLM) on OALV, photoconductive layer (BSO, BGO crystal) locally changes the voltage (U) applied to the liquid crystal layer, which in turn modulates the polarization of coherent RB, and respectively intensity modulation of RW by output polarizer (P). As a result, incoherent WB image imprints on coherent RB.



Nowadays such OALV valves have been used successfully as precision beam shaping devices in high power laser system. These devices in combination with a flaw inspection system and optic registration strategy represents a new approach for extending the operation lifetime of high fluence laser optics. The OALV with dimensions of BSO (and BGO too) crystal 24X36X1 mm were designed with low wavefront distortion (< 0.5 λ for clear aperture of light valve) and high transmission (> 90%) of reading laser beam (1053 nm) for shaping the beam profile at the front-end of large power laser system. The clear aperture of the OALV accommodates 18X18 mm square reading beam profile. OALV spatial resolution mainly depends on the thickness of LC layer, with order values about 25 – 30 lp/mm at 5 mkm thickness of LC layer.

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