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HYBRIDIZED PHOTOVOLTAIC LIQUID CRYSTAL CELLS AND LIGHT VALVES (PREPRINT)

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**Hardened Materials Branch
Survivability and Sensor Materials Division**

JANUARY 2006

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14. ABSTRACT • Can use PV field in LiNbO₃:Fe to activate a liquid crystal • This geometry utilizes the photorefractive effect in the substrates (two-beam coupling) and the scattering effect from the liquid crystal • A less ionic liquid crystal can be used to correct for effects of screening charges.					
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Hybridized Photovoltaic Liquid Crystal Cells and Light Valves



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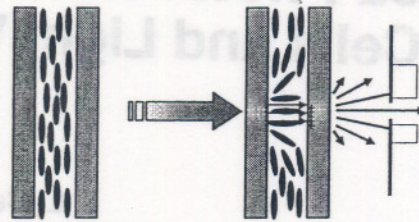
Outline



- Motivation
- Nonholographic Hybrid PV Cells
- Nonholographic Hybrid PV Light Valves
- Conclusions



Motivation



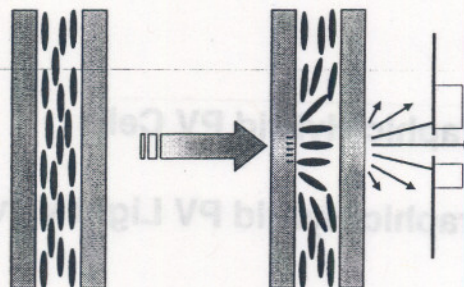
**To develop a self-activated LC cell
using the photovoltaic effect from
photorefractive substrates**



Nonholographic Hybrid PV Cells One Photorefractive Substrate



**Field from one $\text{LiNbO}_3:\text{Fe}$ substrate
activates LC**



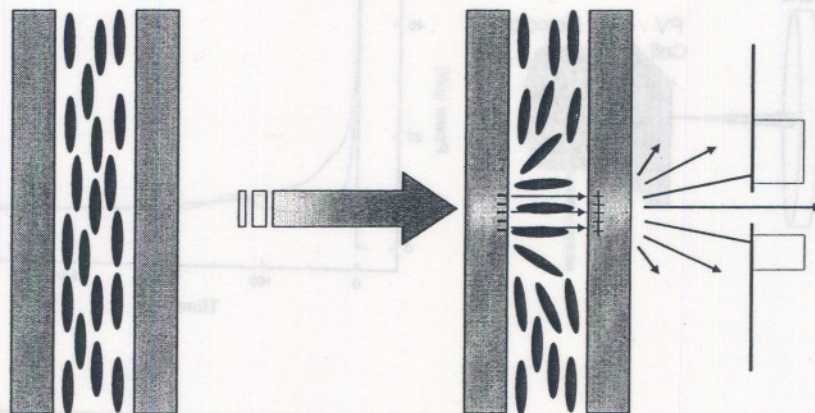
Very sensitive to focal position



Nonholographic Hybrid PV Cells Two Photorefractive Substrates



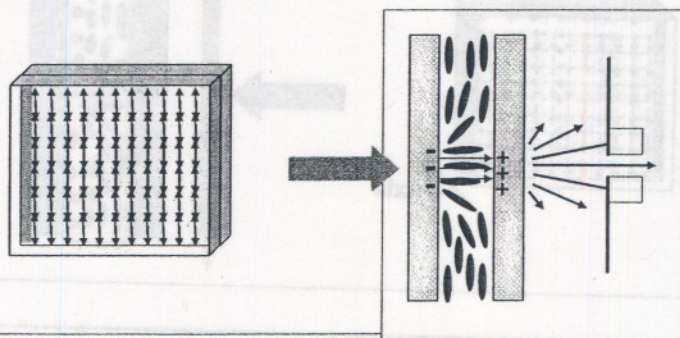
Field between two $\text{LiNbO}_3:\text{Fe}$ substrates
activates LC



Nonholographic Hybrid PV Cells Two Photorefractive Substrates

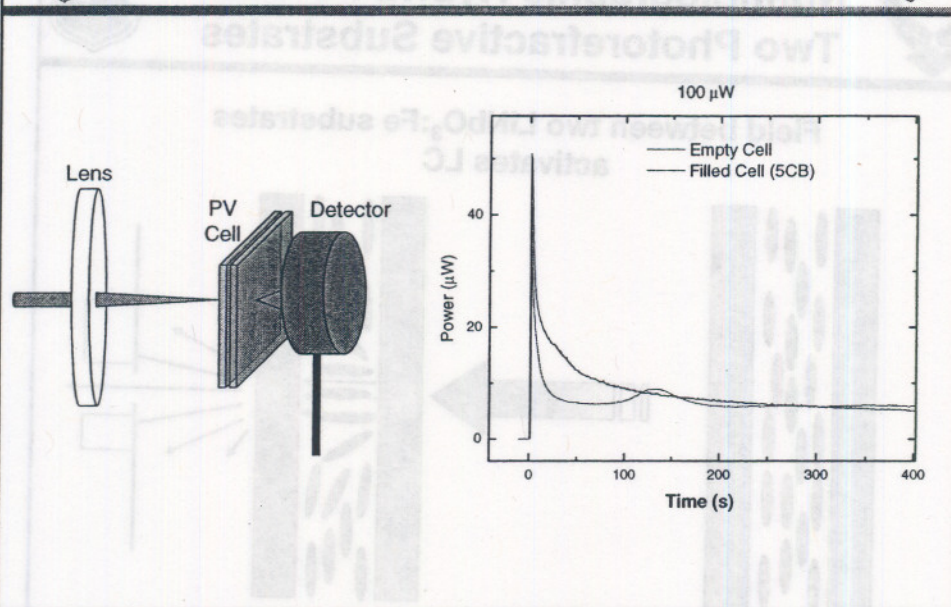


Substrates
0.05% $\text{LiNbO}_3:\text{Fe}$
25 x 25 x 1 mm
 $\alpha_{532} \approx 1.53 \text{ cm}^{-1}$





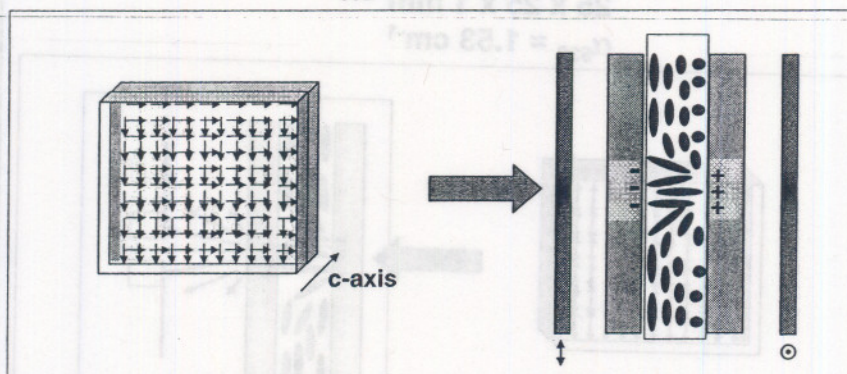
Nonholographic Hybrid PV Cells Two Photorefractive Substrates



Nonholographic Hybrid PV Light Valves Twisted Nematics

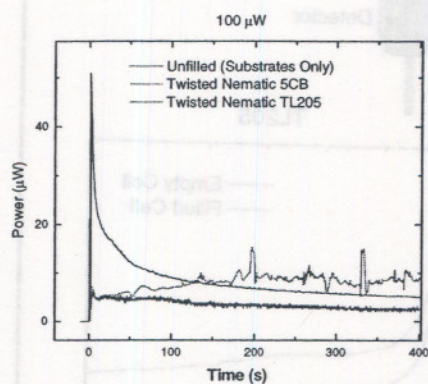


Substrates
0.05% $\text{LiNbO}_3:\text{Fe}$
25 x 25 x 1 mm
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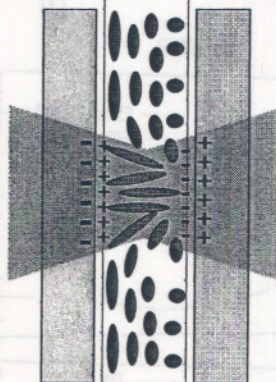


Nonholographic Hybrid PV Light Valves Twisted Nematics

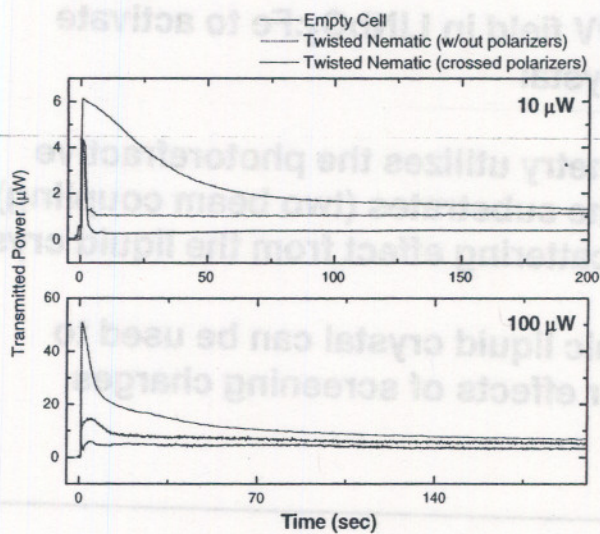


Less ionic LC (TL205) reduces
buildup of screening charges,
allowing DOD to increase

Screening Charges

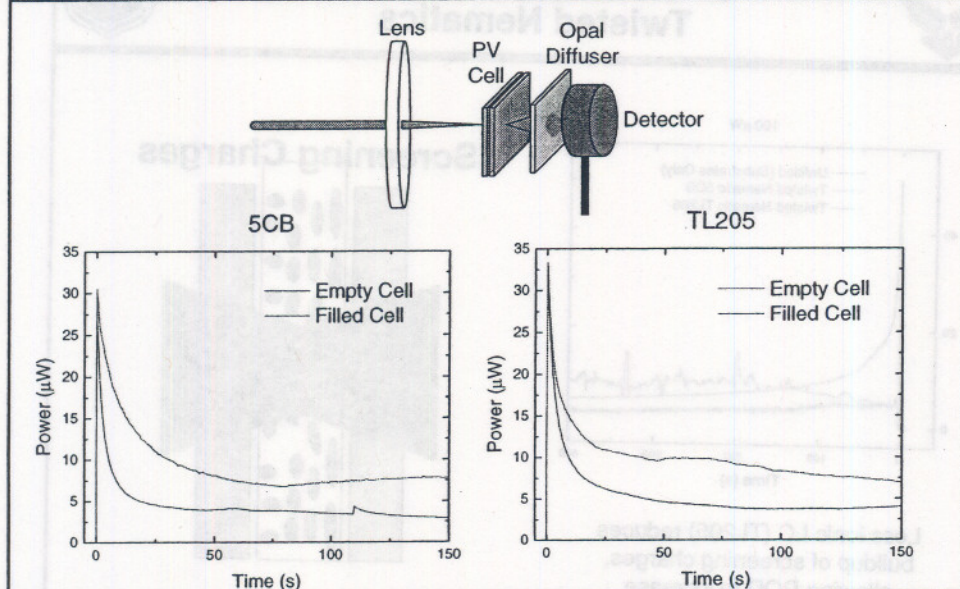


Nonholographic Hybrid PV Light Valves Twisted Nematics





Role of the Liquid Crystal



Conclusions



- Can use PV field in $\text{LiNbO}_3:\text{Fe}$ to activate a liquid crystal
- This geometry utilizes the photorefractive effect in the substrates (two beam coupling) and the scattering effect from the liquid crystal
- A less ionic liquid crystal can be used to correct for effects of screening charges