

## **Modulator Ranking based upon current bias, assuming no fatal flaws**

- **Pockel's Cell:**
  - Wavelength tunable
  - frequency tunable
  - balanced modulation amplitude
  - solid state.
  
- **FLC:**
  - Frequency tunable
  - balanced modulation amplitude
  - solid state
  
- **LCVR modulator+ FLC analyzer:**
  - Wavelength tunable,
  - frequency tunable
  - balanced modulation amplitude
  
- **Rotating XZZY:**
  - Frequency tunable
  
- **Stress:**
  - Frequency tunable (sort of)
  - Wavelength tunable
  - Balanced modulation amplitude
  
- **PEM:**
  - Wavelength tunable
  
- **Pi Cells**
  - Frequency tunable
  - balanced modulation amplitude
  - solid state
  - wide field
  -
  
- **Other liquid crystals**
  - depends

## **Possible Fatal Flaws with opinion on severity**

**Red is likely, Blue is concern**

- **Pockel's Cell:**
  - Wavelength range
  - Frequency range
  - Flux tolerance
  
- **FLC**
  - Wavelength range
  - Flux tolerance
  
- **LCVR modulator + FLC analyzer**
  - Wavelength range
  - Flux tolerance
  
- **Rotating XYZZY**
  - Unbalanced modulation amplitude
  
- **Stress**
  - Too slow
  
- **PEM**
  - Too fast
  - Dual plate phasing not demonstrated
  
- **Pi Cell**
  - Wavelength range
  - Flux tolerance
  
- **Other LC**
  - Same problems as FLC and LCVR

***Without doing additional research, Rotating XYZZY is Baseline***

## What is XYZZY?

- **Rhomb**
  - Achromatic over full range
  - Best match to requirements of all modulation techniques
  - Mechanical nightmare
  
- **Crystal retarder**
  - Fewest problems with fringing and rotation
  - Panchratnam configuration possible
  - Cannot match modulation amplitude to every line
  
- **Polymer retarder**
  - Panchratnam configuration possible
  - Cannot match modulation amplitude to every line
  
- **Bi-crystalline retarder**
  - Could be achromatic over some range
  - Could be athermal
  - Panchratnam configuration possible (super-achromat)
  - Multiple surfaces with reflections aberrations ...
  - Cannot match modulation amplitude to every line

## **Action Items**

### *Affects choice of modulator...*

**AI 1.** Evaluate Pockel's cells for Wavelength range, frequency response and flux tolerance.

**AI 2.** Evaluate FLCs for extended blue response and total flux tolerance

**AI 3.** Evaluate LCVRs for extended blue response and total flux tolerance

### *Affects choice of modulation rate and detector...*

**AI 4.** Using seeing models, evaluate each possible scheme for cross talk, including modulation amplitude imbalance, a range of frequencies, telescope polarization, and polarization between modulator and analyzer.

**AI 5.** Derive a very good flux budget for each configuration.

## **Course of Action**

### ***Choose modulator***

**If AI 1 shows Pockel's cell is OK then Pockel's cell is baseline**

**Else If AI 2 shows FLC is OK then FLC is baseline**

**Else IF AI 3 shows LCVR+LFC is OK then LCVR+FLC is baseline**

**Else rotating XYZZY is baseline**

### ***Choose rates and detectors***

**Perform AI 4 on at lease baseline modulator to determine frequencies and detectors.**

**If rotating XYZZY, perform XYZZY trade study**

### ***Death is in the details***

**Perform detailed analysis of modulator properties.**