

## ATST Modulator Matrix

4/17/2002 Elmore, Keller, Tomczyk, Judge

Type	Rates	States	Wavelength Range	Tunability	Achromatic	Efficiency	Polarization Crosstalk	Fringing	mm Size Maximum	arcmin Field of View	20000 Entendue	Flux watt/cm <sup>2</sup>	Flux watt/cm <sup>2</sup>	Thermal Sensitivity	Mechanical Size	Detectors	Special
Ferroelectric LC	0-4kHz	4	400-1600	a	b,c	0.577	0	d	50	600	30000	6.4	1	e	50+	all	f,h
Nematic LC	0-50Hz	4	400-1600	yes	no	0.577	0	good	50	600	30000	6.4	1	g	50+	all	h
Rotating retarder	0-1kHz	8	296-1600	a	b	0.506	k,n	good	125	180	22500	1.024	lots	l	Large	all	m
PEM	100kHz	4	296-1600	yes	no	0.5	n	good	50	3000	150000	6.4	lots	good	50+	C3Po	p
Rotating retarder & PEM or FLC	slow & fast	8	296-1600	a	b	0.506	k,n	d	125	180	22500	1.024	lots	1	Large	C3Po	o
Pockel's Cell	0-n kHz	4	400-1600	yes	no	0.577	n	good	100	120	12000	1.6	q	?	100+	all	r
Stress Birefringer	slow	4	296-1600	yes	no	0.577	0	good	500	120	60000	0.064	lots	?	Large	all	s
Rotating Fresnel Rhomb other LC	0-1kHz	8	296-1600	na	yes	0.506	k,n	good	167	120	20000	0.576	lots	good	Huge	all	t,m

z In all cases the influence of telescope polarization between the modulator and analyzer has not been included.

a Panchratnam arrangement could rotate center element to obtain desired retardance at a range of wavelengths. Fast axis will wander. Retardance tunability a possibility.

b Pnchratnam fixed arrangement would be achromatic. Multiple panchratnam plates possible.

c Combination of LC materials may be possible for achromaticity.

d Fringing depends upon the number of surfaces. A Panchratnam configuration could have significant fringes

e Range of axis switching is a function of temperature. Range diminishes approximately .7degrees/C

f Low voltage switchable.

g Approximately 0.25 degrees of retardance/C

h Careful characterization of retardance vs voltage and temperature is important.

j Achromatic bi-crystalline retarders have been fabricated. Super achromatic panchratnam retarder is possible

k Since all states not modulated with equal efficiency, telescope polarization variations from intensity leak into polarizaiton

l Thermal sensitivity of a crystal or bi-crystalline achromat is large. An athermal bi-crystalline non-achromat has been designed.

m Rotating mechanical device must have good servo and is very large compared to optic.

n Modulation could be fast compared to seeing therefore eliminating crosstalk. If fast enough only one beam is needed.

o Similar system used in Mk4. Frequency response has not been modeled.

p Precise phasing of two PEMs and detector has not yet been demonstrated

q Depends upon conducting layer

r Much progress since Stokes II. Research needed here.

s A lot of energy to create retardance. Nearly uncharted territory.

t Huge mechanical beast. Do not now know how to make a retarder of about 3/8 wave.

C3Po = Charge Caching Cmos PhOtodetector? Can we count on one of these for ATST?

Detectors CCD, HgCdTe, C3Po vis or IR