University of Michigan Variability Program

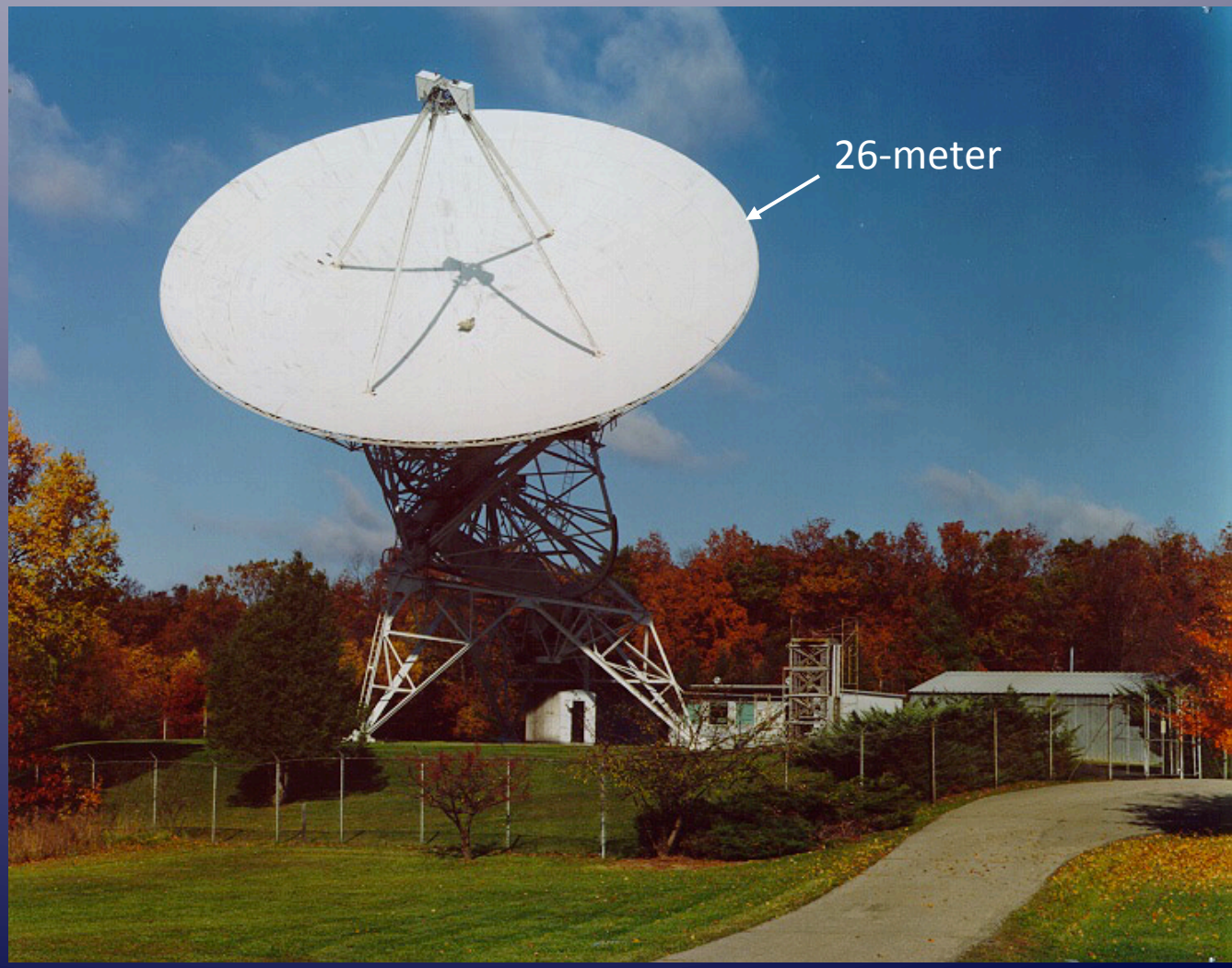
H.D. Aller, M.F. Aller, & P.A. Hughes

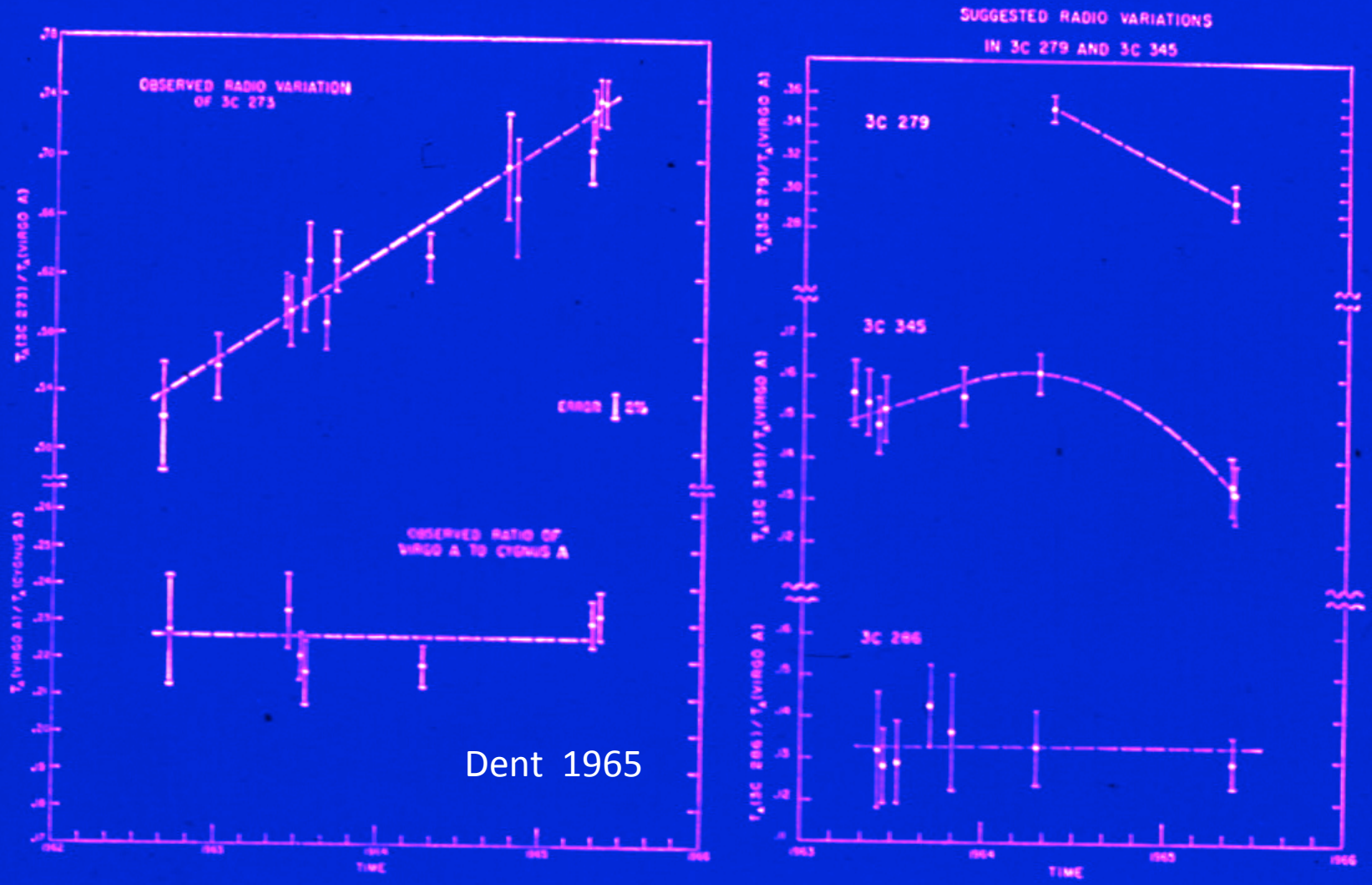
Three Frequencies

8.0 GHz (1965)
14.5 GHz (1974)
4.8 GHz (1978)

Wide bandwidth
(10% of Frequency)

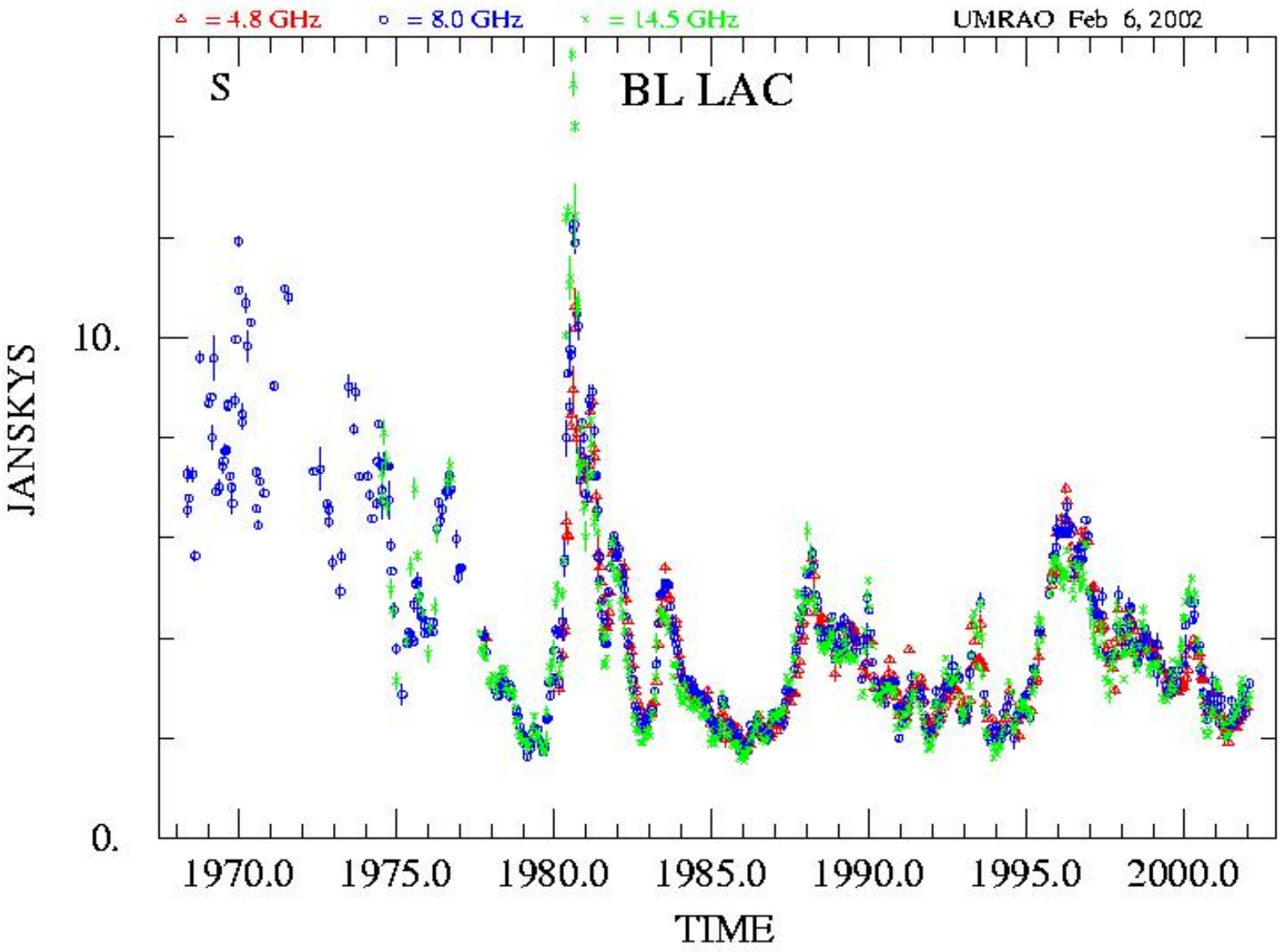
Automatic
Observing
(computer control)
Since 1978

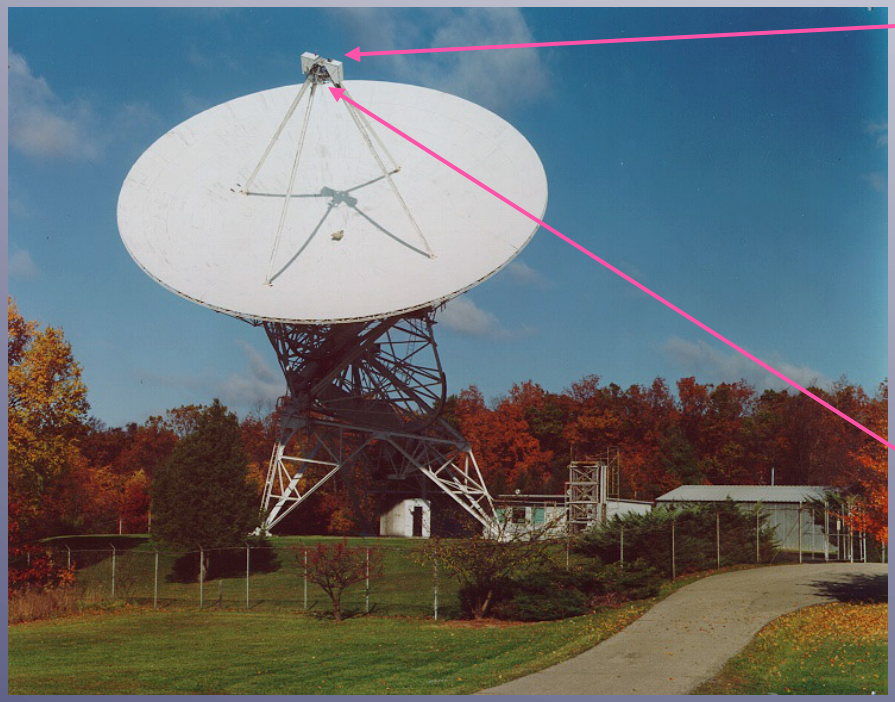


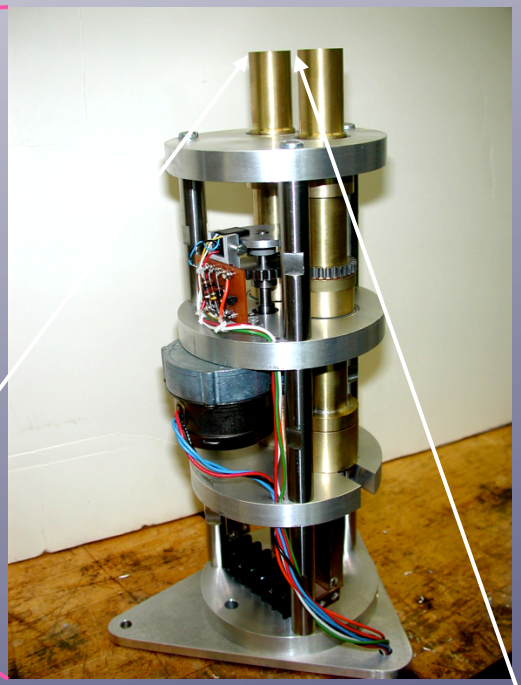


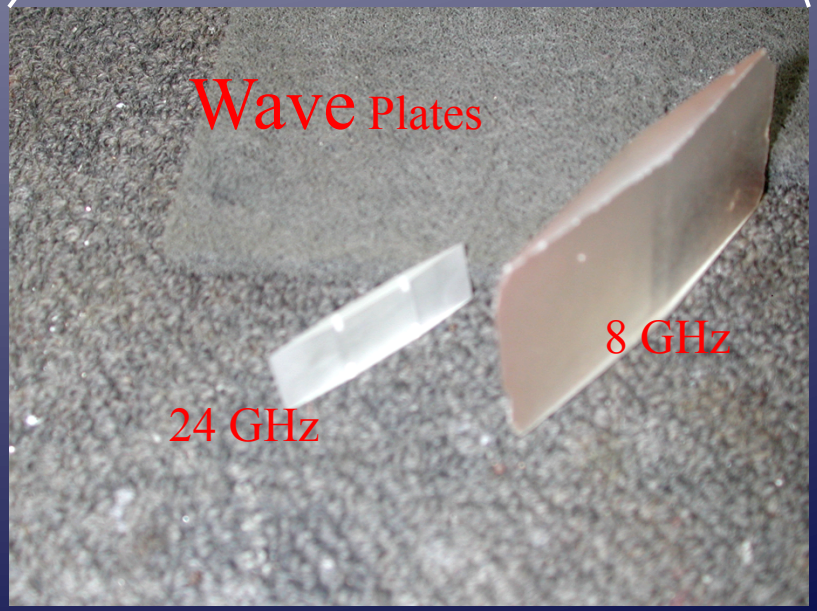
Dent 1965

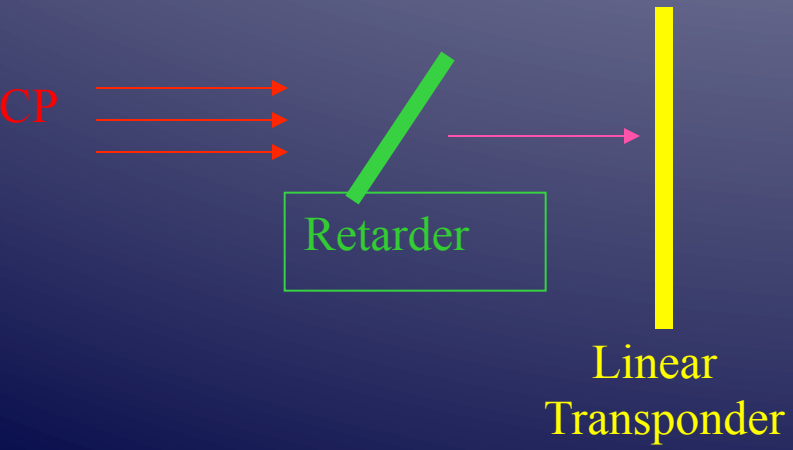
Fig. 1 (left). The ratio of the corrected antenna temperature, T_A, at 8000 Mc/sec of the quasi-stellar source 3C 273 to that of Virgo A, showing the observed 40-percent increase in the radio emission over a nearly three-year period. The measured ratio of Virgo A to Cygnus A shows no variation over the same period. Fig. 2 (right). Evidence for possible variations in the radio emissions of the quasi-stellar sources 3C 279 and 3C 345 at 8000 Mc/sec, and for a lack of variation in the quasi-stellar source 3C 286. Like 3C 273, which shows variations, both 3C 279 and 3C 345 have flat radio spectra at 8000 Mc/sec.

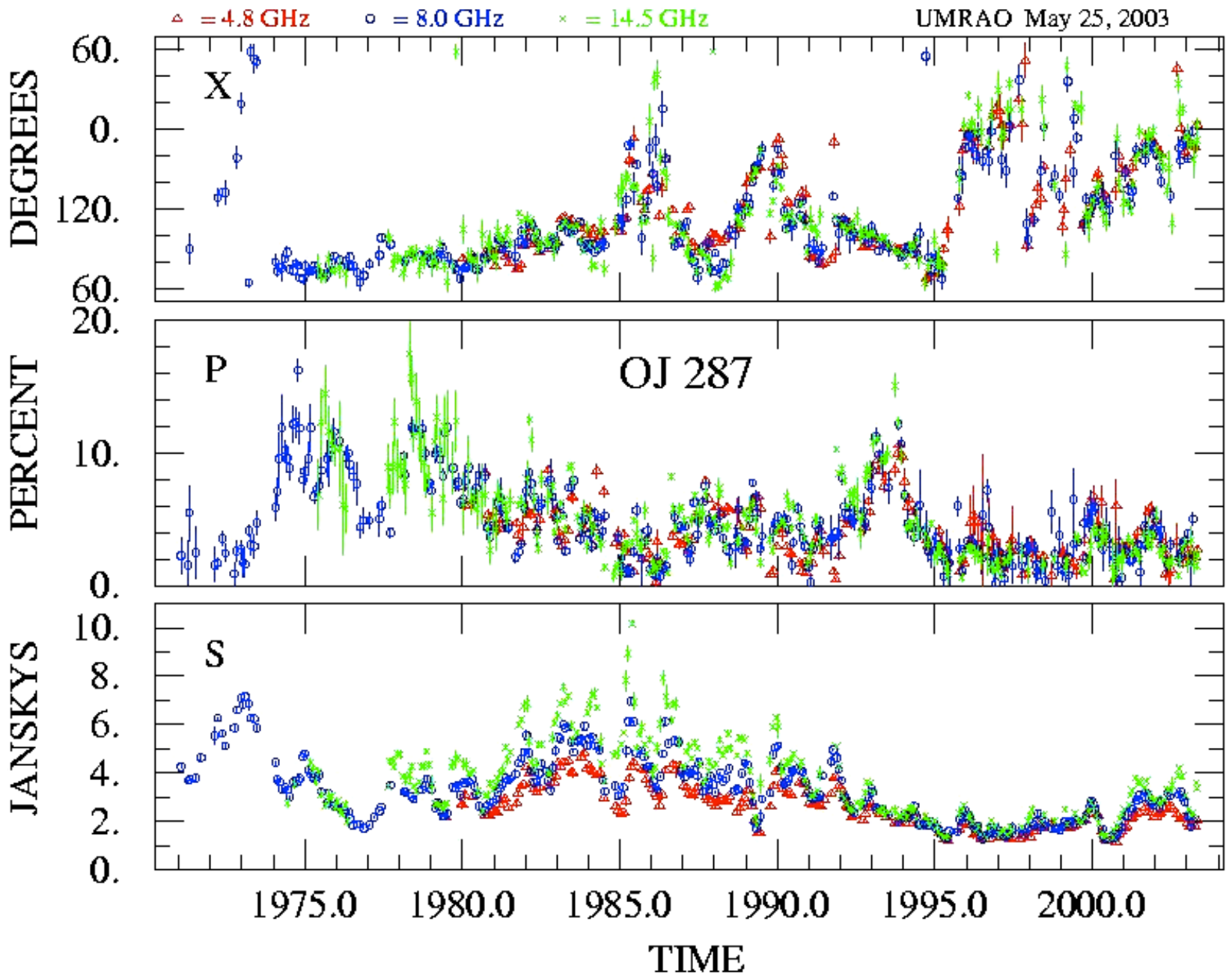

= 4.8 GHz
= 8.0 GHz
= 14.5 GHz
UMRAO Feb 6, 2002
S
BL LAC
JANSKYS
10.
0.
1970.0
1975.0
1980.0
1985.0
1990.0
1995.0
2000.0
TIME

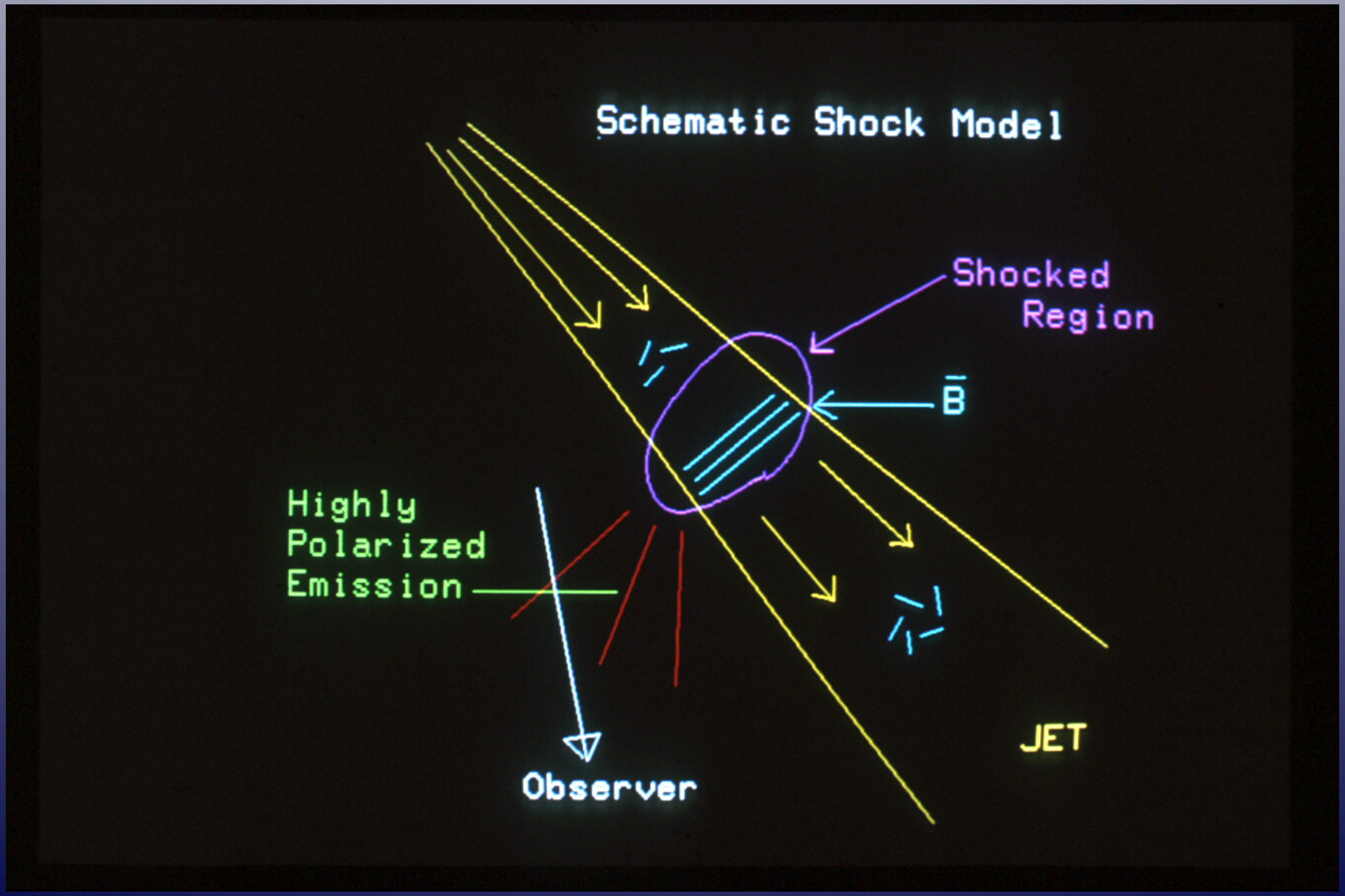


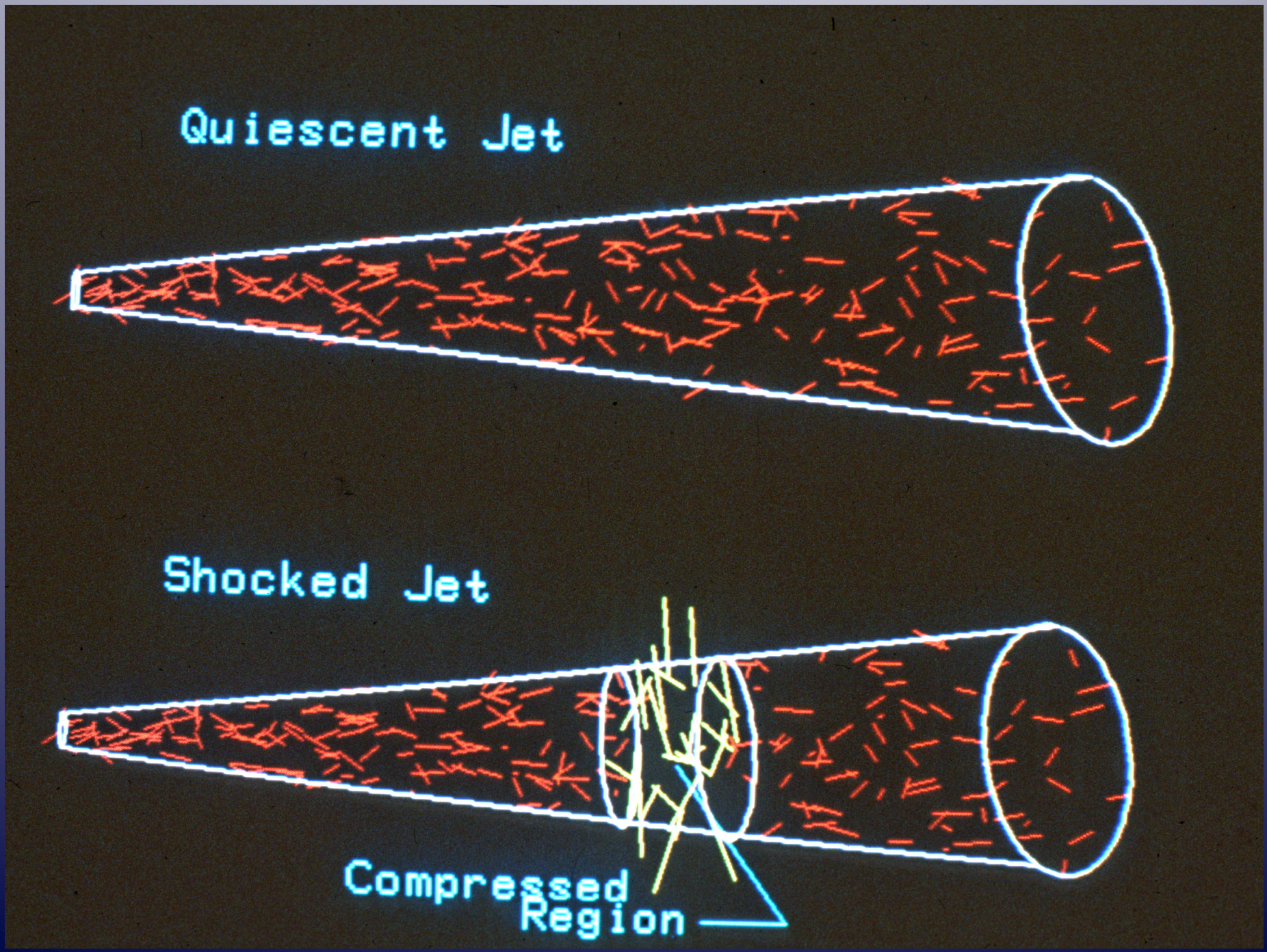



Wave Plates
8 GHz
24 GHz

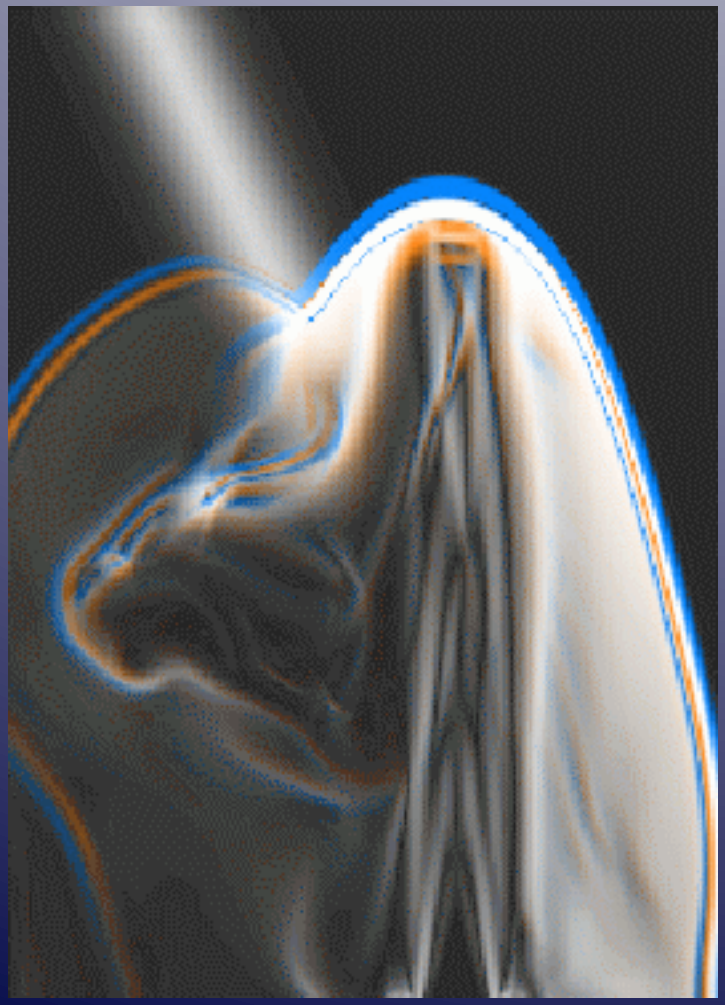

CP
Retarder
Linear
Transponder


= 4.8 GHz
= 8.0 GHz
= 14.5 GHz
UMRAO May 25, 2003
X
DEGREES
60.
0.
120.
60.
P
OJ 287
PERCENT
20.
10.
0.
S
JANSKYS
10.
8.
6.
4.
2.
0.
1975.0
1980.0
1985.0
1990.0
1995.0
2000.0
TIME

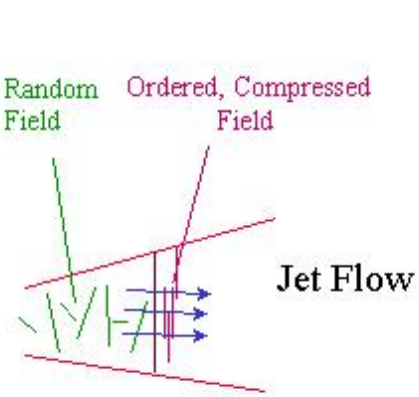

Schematic Shock Model
Shocked
Region
B
Highly
Polarized
Emission
JET
Observer


Quiescent Jet
Shocked Jet
Compressed
Region

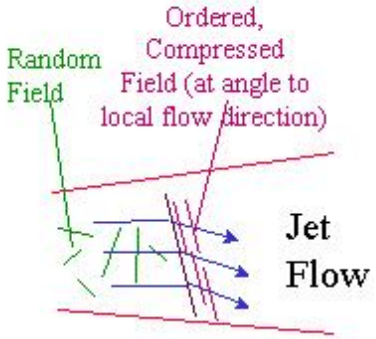
3-D Relativistic Hydro Simulation: Jet incident on a density gradient.
P.A. Hughes et al.



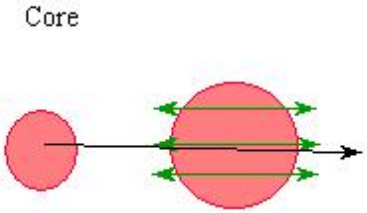
Transverse Shock



Oblique Shock

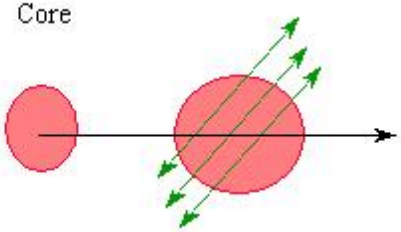


What is Observed

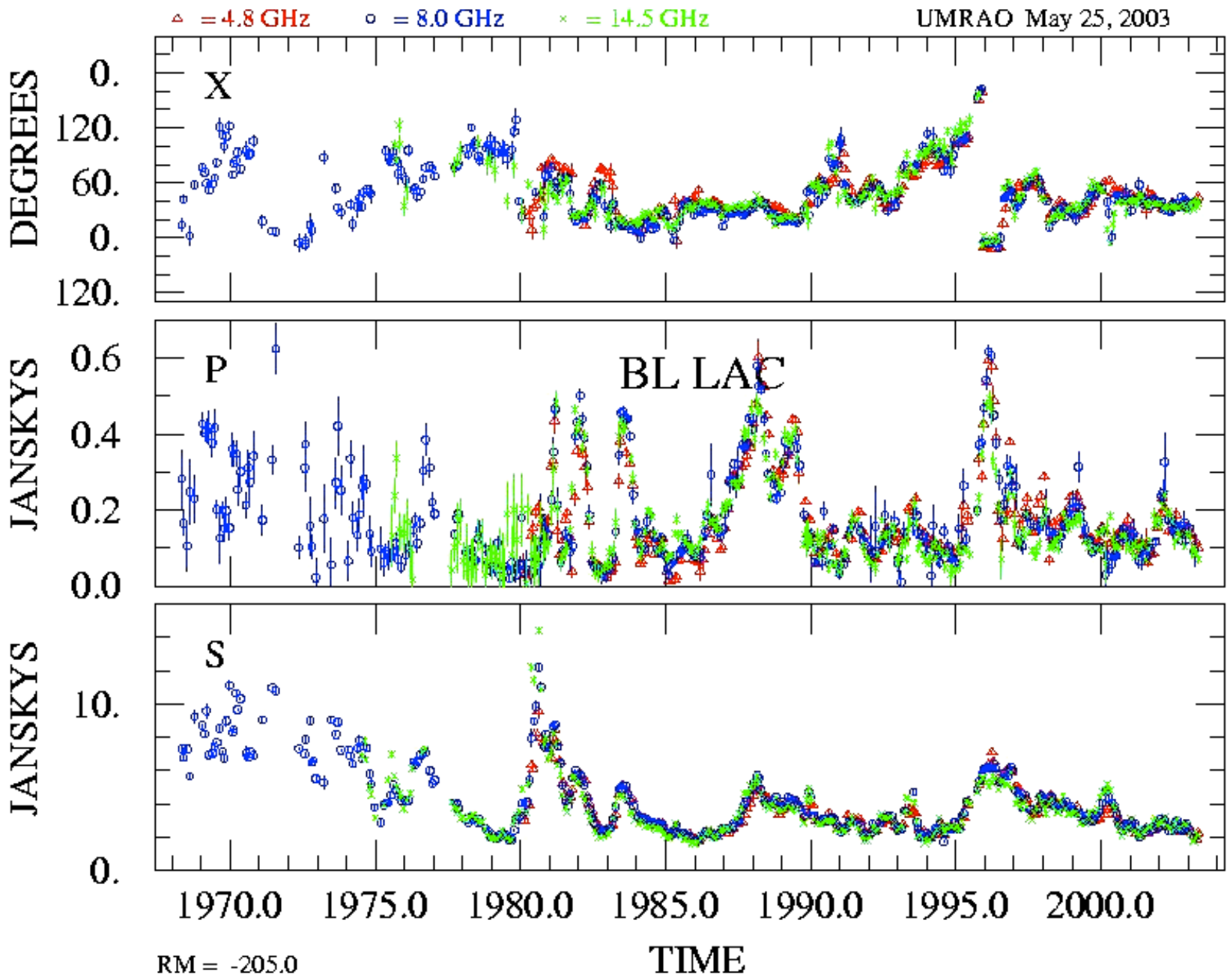


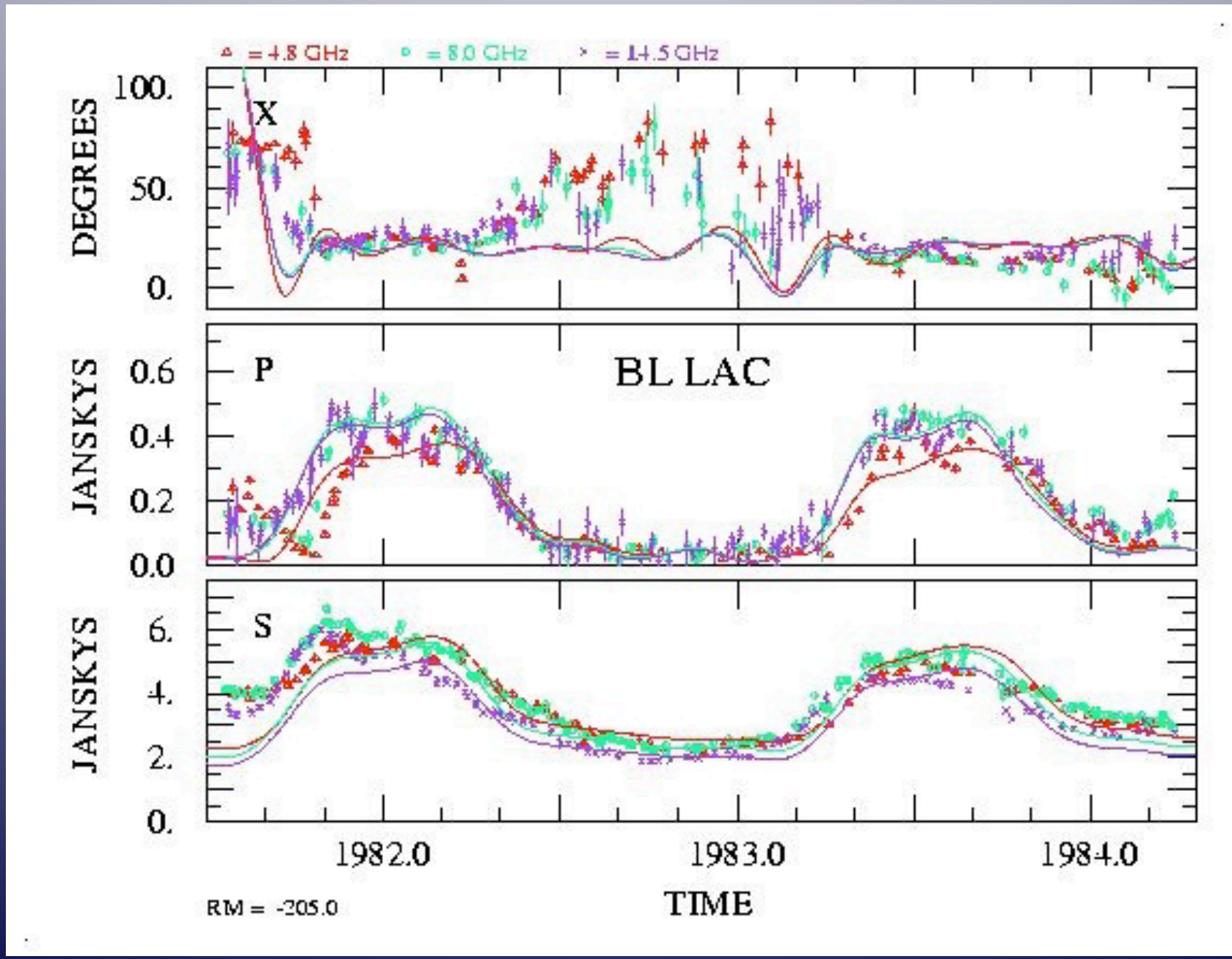
Electric Vector Parallel to Axis

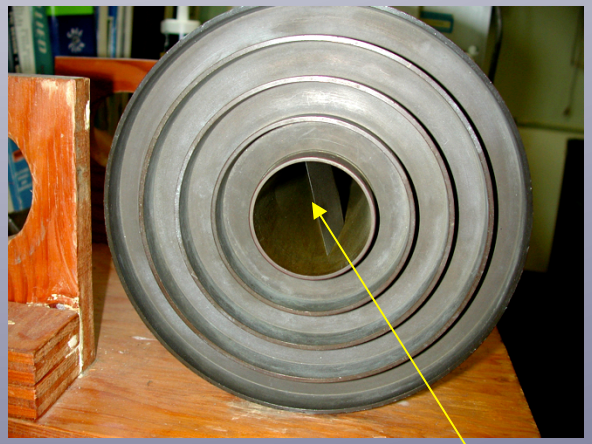
What is Observed



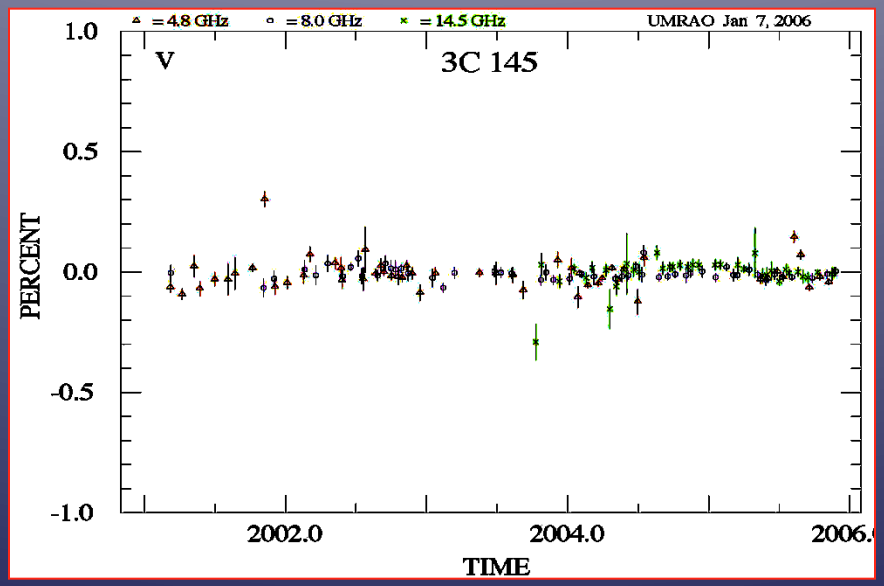
Electric Vector at Angle to Axis


△ = 4.8 GHz
○ = 8.0 GHz
× = 14.5 GHz
UMRAO May 25, 2003
X
DEGREES
0.
120.
60.
0.
120.
P
BL LAC
JANSKYS
0.6
0.4
0.2
0.0
S
JANSKYS
10.
0.
1970.0
1975.0
1980.0
1985.0
1990.0
1995.0
2000.0
TIME
RM = -205.0


= 4.8 GHz
= 8.0 GHz
= 14.5 GHz
DEGREES
100.
50.
0.
X
JANSKYS
0.6
0.4
0.2
0.0
P
BL LAC
JANSKYS
6.
4.
2.
0.
S
1982.0
1983.0
1984.0
RM = -205.0
TIME

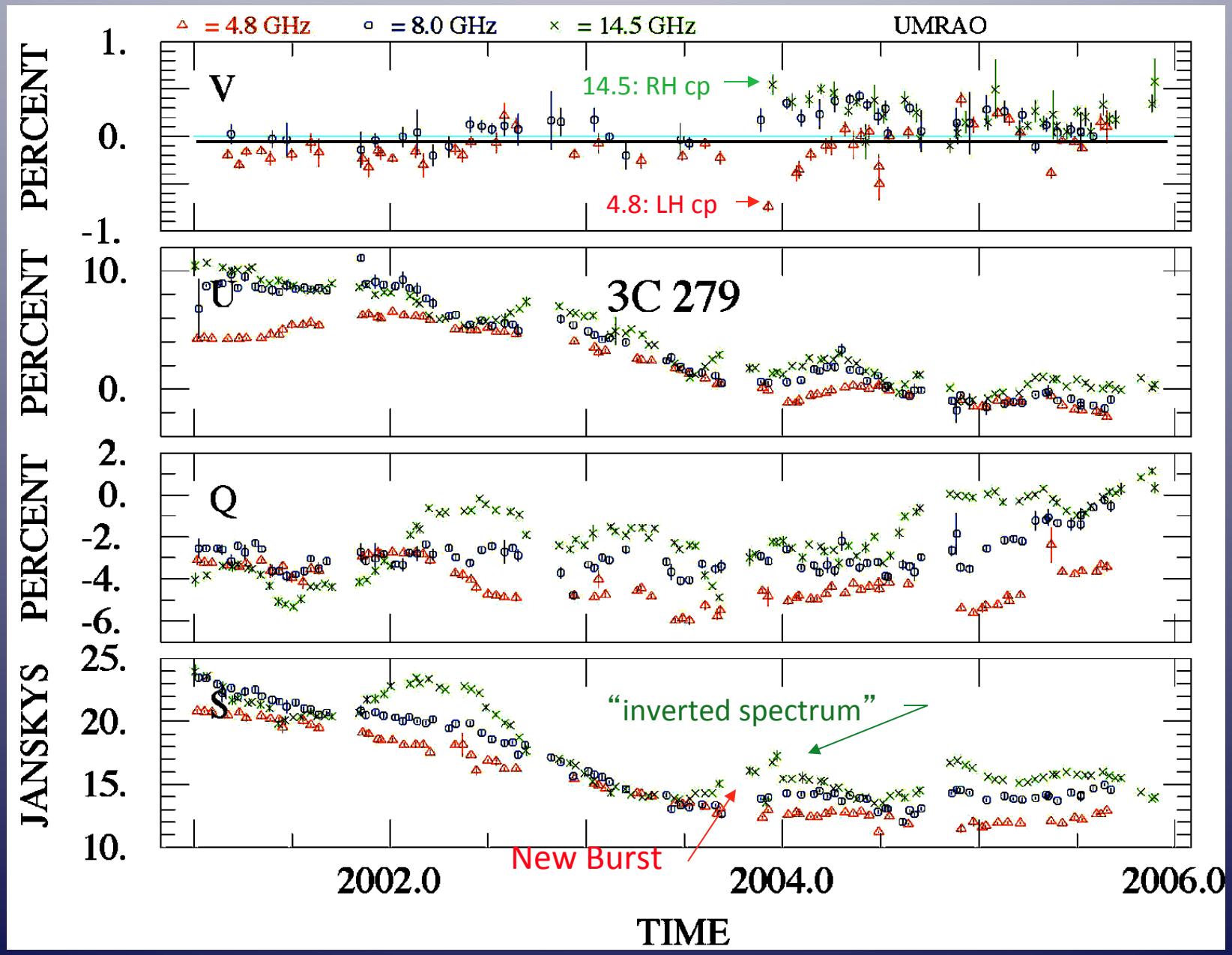


Quarter Wave Plate



3 Frequencies
4.8 GHz
8.0 GHz
14.5 GHz

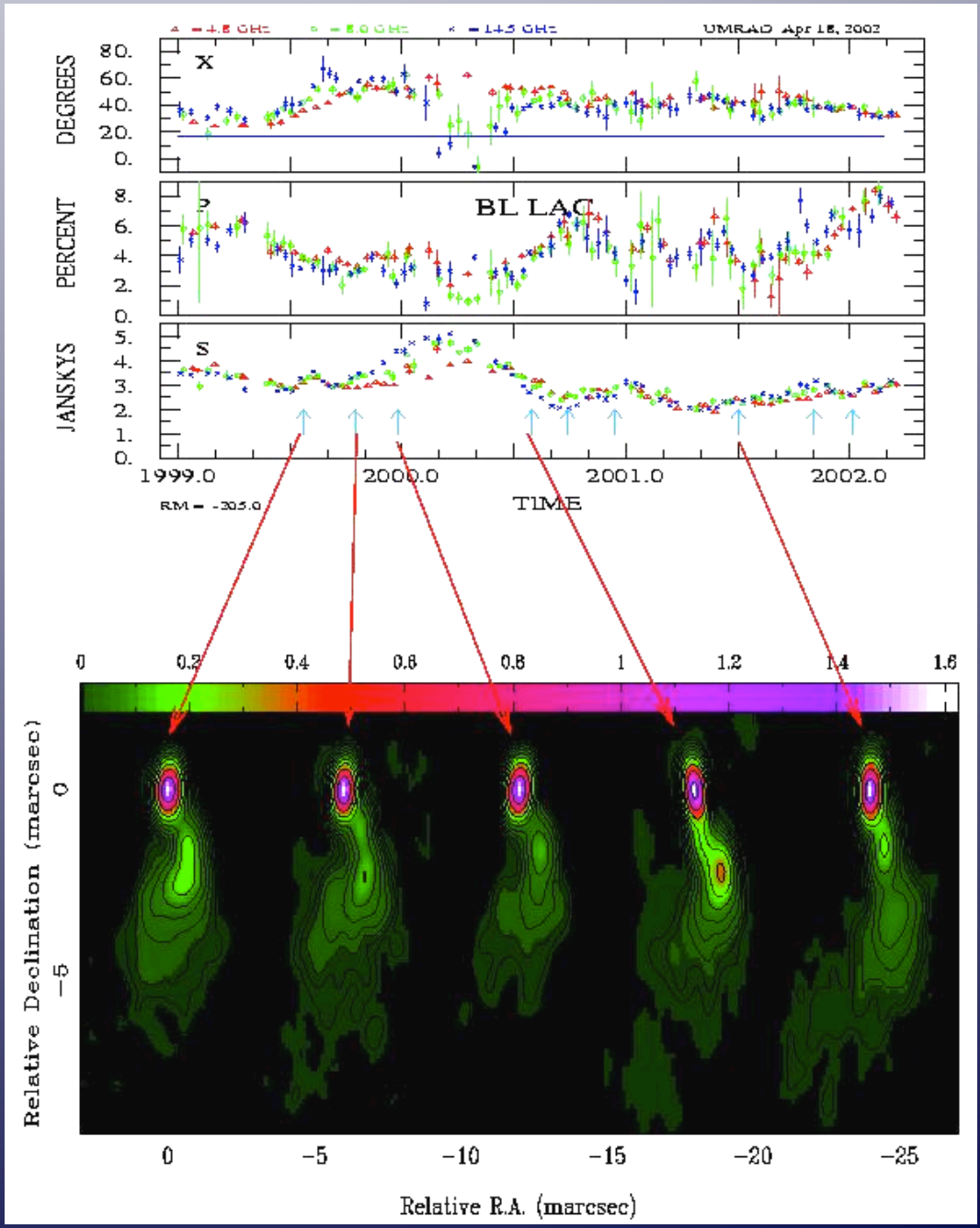
H II Region (Cal.)


= 4.8 GHz
= 8.0 GHz
= 14.5 GHz
UMRAO
V
14.5: RH cp
4.8: LH cp
U
3C 279
Q
I
"inverted spectrum"
New Burst
PERCENT
PERCENT
PERCENT
JANSKYS
1.
0.
-1.
10.
0.
2.
0.
-2.
-4.
-6.
25.
20.
15.
10.
2002.0
2004.0
2006.0
TIME

Michigan variability program (three frequencies)

BL Lac

VLBA images At 15.5 GHz



Michigan 26-m

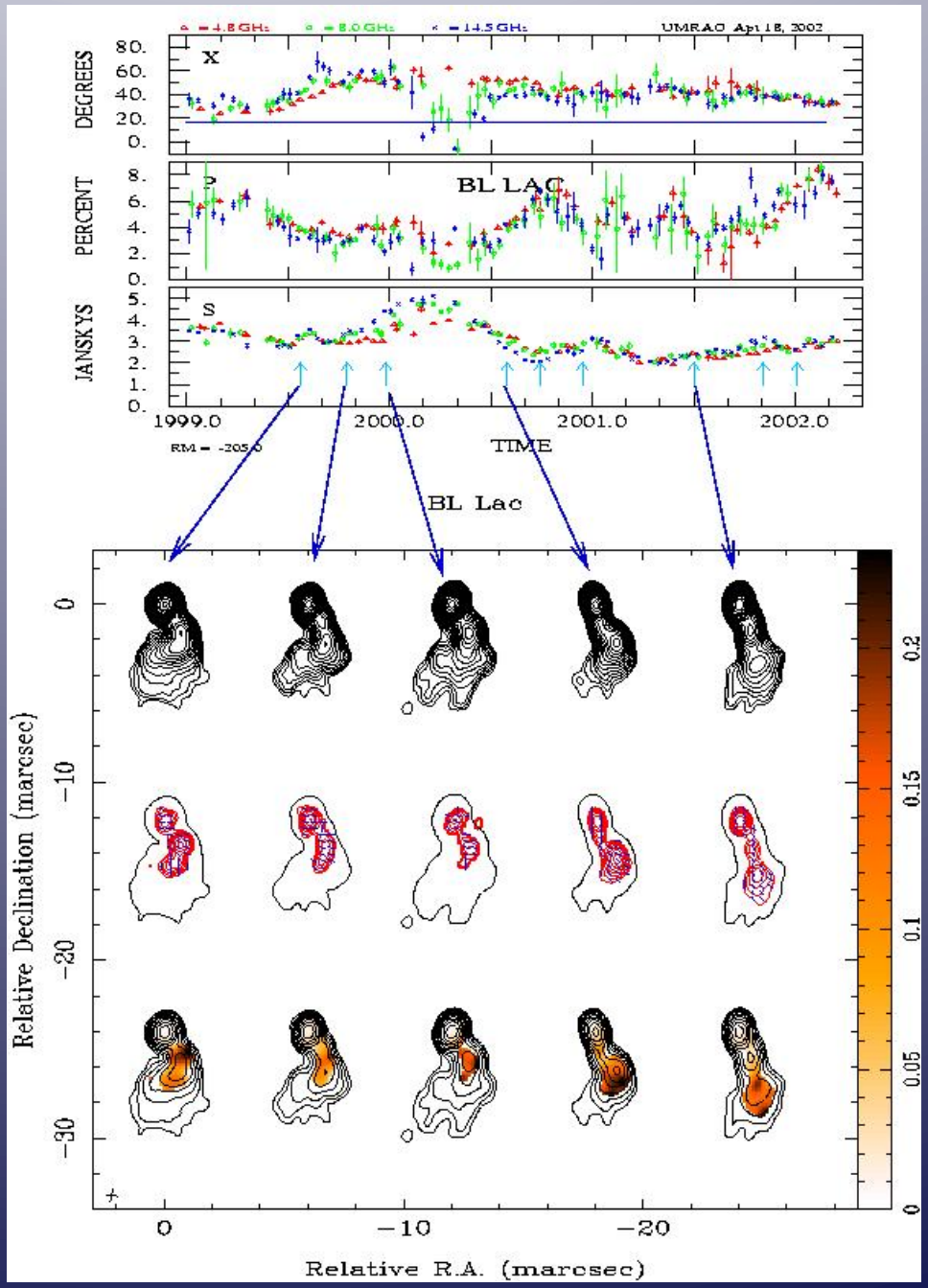
Integrated Flux
And Polarization

VLBA

Total Flux Contours

Polarized Flux & PA

Color Coded Pol. Flux



Theoretical Considerations

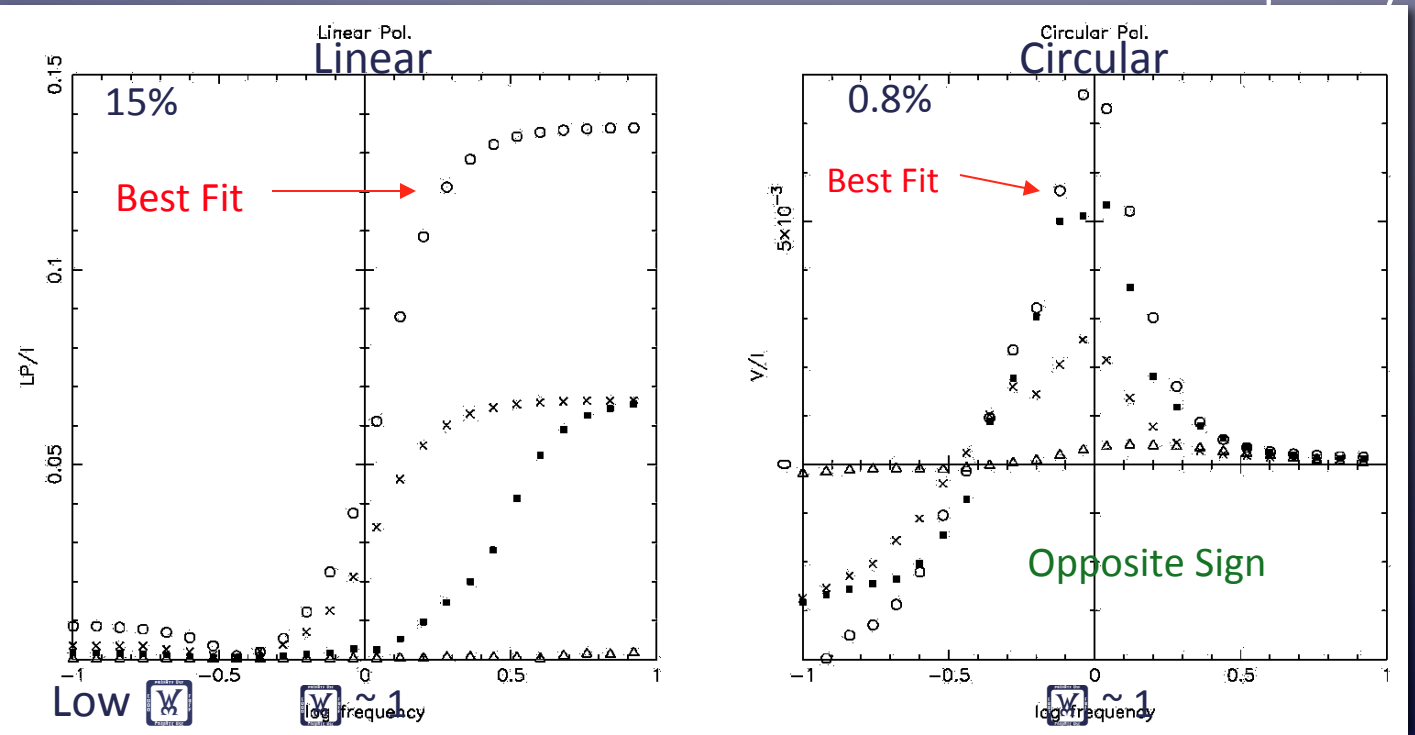
CP generation via "Mode Conversion" Ref: Jones & O' Dell (1977)

Linear Pol. -> CP via phase shift induced by Relativistic Electrons and Magnetic Fields in emitting region.

It is a "stochastic process"

- o Conversion suppressed if particles highly relativistic
  =>Only the low-energy tail is important to the process
- o Conversion suppressed if B-field is highly tangled

Numerical Simulation: 30X30X30 Random Cells: P. Vs Frequency



Best Fit Param.
25% of B ordered

W_{Min} ~ 100