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THE LBW FEED: THE MUELLER MATRIX IN 1999 AND 2000

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ABSTRACT

We present measurements of the Mueller matrix and associated quantities at two epochs for 1420.4 MHz (February-March 1999 and March 2000) and one for 1665.3 MHz (March 2000).

1. SUMMARY AND RESULTS

In AOTM 99-01, we presented the theory and practice of deriving the Mueller matrix for the LBW system. We also presented the result we derived during Feb-Mar99. We repeated these measurements in March 2000, using much less integration time and only three sources (P0736+01, 3C454.3, 3C286); consequently, the more recent results have larger uncertainties. Nevertheless, the agreement between the two years at 1420.4 MHz, and for the second year between the two frequencies, is good. This provides confidence that our measurements are meaningful.

All quantities are as defined in AOTM 99-01 as the elements of $\mathbf{M}_{\mathbf{A}+\mathbf{F}}$; there are only six independent elements. We present five below; the sixth element m_{QU} represents the mechanical rotational offset of the dipoles from their nominal position angles, which translates directly into an error of the measured position angles; it is zero by assumption. One of the remaining is forced to zero by adjusting the cal values $TCAL_{xx}$ and $TCAL_{yy}$, and one more is forced to zero by correcting for the phase difference between sky and cal, denoted in the table by $\Delta\Phi$.

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Table 1. MUELLER MATRIX ELEMENTS AND ASSOCIATED QUANTITIES:
TWO YEARS, TWO FREQUENCIES

Quantity	Mar99, 1420.4	Mar00, 1420.4	Mar00, 1665.3
m_{QI}	0 ± 0.0004	0 ± 0.0007	0 ± 0.0005
m_{UI}	0.0112 ± 0.0002	0.0065 ± 0.0007	0.0044 ± 0.0006
m_{VI}	-0.0055 ± 0.0002	-0.0032 ± 0.0002	-0.0022 ± 0.0004
m_{VQ}	-0.0088 ± 0.0024	-0.0061 ± 0.0039	-0.0095 ± 0.0067
m_{VU}	0 ± 0.0021	0 ± 0.0038	0 ± 0.0049
$TCAL_{xx}$	10.33	10.14	10.21
$TCAL_{yy}$	9.62	9.80	9.73
$\Delta\Phi$	$2.37^\circ \pm 0.12^\circ$	$3.19^\circ \pm 0.22^\circ$	$3.37^\circ \pm 0.28^\circ$

Note. — The $TCAL$'s are in Kelvins and are the values required to force $m_{QI} = 0$. The “official” values at 1420.4 MHz are 10.76 and 9.25 K; we adjusted our values so as to keep the sum constant.

Note. — $\Delta\Phi = \Phi_{XY,SKY} - \Phi_{XY,CAL}$ as defined in §2.1 of AOTM 99-01. It is the value required to force $m_{VU} = 0$.