TABLE II: Polarization matrices on all accessible magnetic Bragg reflections of $NdFe_3(^{11}BO_3)_4$ are shown for T = 20 K. The column $\boldsymbol{P}_0$ and $\boldsymbol{P}'$ denote the direction of the initial and final polarization vector, respectively. The subscripts of $\boldsymbol{P}'$ indicate the polarization matrices that were measured (*meas*) and calculated (*calc*) from the two distinct magnetic models models (M1a) and (M2). The polarization tensor elements marked in bold demonstrate where model (M2) does not match the data.

				$\boldsymbol{P}'_{meas}$			$\boldsymbol{P}'_{calc}(M1a)$			$\boldsymbol{P}'_{calc}(M2)$		
H	K	L	$\boldsymbol{P}_0$	x	y	z	x	y	z	x	y	z
+0.0	+2.0	−0.5	$+x$	−0.861(3)	+0.073(6)	+0.042(6)	−0.869	+0.000	+0.000	−0.868	+0.000	+0.000
			$+y$	−0.059(6)	−0.659(4)	−0.050(6)	+0.000	−0.756	+0.000	+0.002	−0.752	+0.000
			$+z$	+0.043(6)	−0.050(6)	+0.655(4)	+0.000	+0.000	+0.756	+0.002	+0.000	+0.752
			$-x$	+0.876(3)	−0.026(6)	−0.031(6)	+0.869	+0.000	+0.000	+0.869	+0.000	−0.000
			$-y$	+0.034(6)	+0.659(4)	+0.059(6)	+0.000	+0.756	+0.000	+0.002	+0.752	+0.000
			$-z$	−0.081(6)	+0.043(6)	−0.655(4)	+0.000	+0.000	−0.756	+0.002	+0.000	−0.752
+0.0	+0.0	−1.5	$+x$	−0.872(2)	+0.057(4)	+0.119(4)	−0.869	+0.000	+0.000	−0.869	+0.000	+0.000
			$+y$	−0.010(4)	+0.010(4)	+0.019(4)	−0.000	+0.000	−0.000	+0.000	+0.000	+0.000
			$+z$	−0.032(4)	+0.020(4)	−0.007(4)	+0.000	−0.000	−0.000	+0.000	+0.000	−0.000
			$-x$	+0.872(2)	−0.058(3)	−0.115(3)	+0.869	+0.000	+0.000	+0.869	+0.000	+0.000
			$-y$	−0.043(4)	−0.018(4)	−0.017(4)	−0.000	−0.000	+0.000	+0.000	−0.000	−0.000
			$-z$	−0.019(4)	−0.023(4)	+0.017(4)	+0.000	+0.000	+0.000	+0.000	−0.000	+0.000
+0.0	+4.0	+0.5	$+x$	−0.853(7)	+0.06(1)	+0.01(1)	−0.869	+0.000	+0.000	−0.869	+0.000	+0.000
			+y	−0.05(1)	−0.837(8)	−0.05(1)	+0.000	−0.869	+0.000	−0.004	−0.866	+0.000
			$+z$	+0.03(1)	−0.02(1)	+0.826(8)	+0.000	+0.000	+0.869	−0.004	+0.000	+0.866
			$-x$	+0.850(7)	+0.02(1)	+0.03(1)	+0.869	+0.000	+0.000	+0.868	+0.000	+0.000
			$-y$	−0.01(1)	+0.807(8)	+0.08(1)	+0.000	+0.869	−0.000	−0.004	+0.866	+0.000
			$-z$	−0.08(1)	+0.08(1)	−0.851(7)	+0.000	−0.000	−0.869	−0.004	−0.000	−0.866
+0.0	−2.0	−2.5	$+x$	−0.871(4)	+0.068(7)	+0.107(7)	−0.869	−0.000	+0.000	−0.869	−0.000	+0.000
			+y	−0.092(7)	−0.081(7)	−0.012(7)	+0.000	−0.184	−0.001	−0.003	−0.170	−0.000
			$+z$	−0.017(7)	−0.006(7)	+0.100(7)	+0.000	+0.001	+0.184	−0.003	−0.000	+0.170
			$-x$	+0.876(4)	−0.045(7)	−0.102(7)	+0.869	+0.000	+0.000	+0.868	−0.000	−0.000
			$-y$	−0.005(7)	+0.085(7)	+0.030(7)	+0.000	+0.184	−0.001	−0.003	+0.170	+0.000
			$-z$	−0.064(7)	+0.030(7)	−0.087(7)	+0.000	−0.001	−0.184	−0.003	+0.000	−0.170
+0.0	+1.0	−2.5	$+x$	−0.860(8)	+0.07(2)	+0.11(2)	−0.869	+0.000	+0.000	−0.898	+0.000	−0.000
			+y	−0.04(2)	−0.08(2)	+0.01(2)	+0.000	−0.055	+0.000	**−0.285**	**−0.649**	+0.000
			$+z$	−0.04(2)	−0.01(2)	+0.11(2)	0.000	+0.000	+0.055	**−0.285**	−0.000	**+0.649**
			$-x$	+0.851(8)	−0.07(2)	−0.10(1)	+0.869	−0.000	+0.000	+0.816	+0.000	+0.000
			$-y$	−0.02(2)	+0.10(2)	+0.02(2)	+0.000	+0.055	+0.000	**−0.285**	**+0.649**	−0.000
			$-z$	−0.03(2)	+0.02(2)	−0.05(2)	+0.000	+0.000	−0.055	**−0.285**	−0.000	**−0.649**
+0.0	+1.0	+0.5	$+x$	−0.876(3)	+0.037(7)	+0.084(7)	−0.869	+0.000	+0.000	−0.846	+0.000	−0.000
			+y	−0.078(7)	−0.485(6)	−0.083(7)	+0.000	−0.544	+0.000	**+0.148**	**−0.798**	−0.000
			$+z$	+0.069(7)	−0.062(7)	+0.481(6)	+0.000	+0.000	+0.544	**+0.148**	+0.000	**+0.798**
			$-x$	+0.880(3)	−0.009(7)	−0.044(7)	+0.869	−0.000	−0.000	+0.886	+0.000	+0.000
			$-y$	+0.010(7)	+0.495(6)	+0.079(7)	+0.000	+0.544	+0.000	**+0.148**	**+0.798**	+0.000
			$-z$	−0.101(7)	+0.070(7)	−0.478(6)	+0.000	+0.000	−0.544	**+0.148**	+0.000	**−0.798**

and $\boldsymbol{P''}$ are reduced to

$$\sigma\tilde{\boldsymbol{P}} = \begin{pmatrix} -|\boldsymbol{M}_\perp|^2 & 0 & 0 \\ 0 & |M_{\perp y}|^2-|M_{\perp z}|^2 & 2\Re(M^*_{\perp y}\cdot M_{\perp z}) \\ 0 & 2\Re(M^*_{\perp y}\cdot M_{\perp z}) & -|M_{\perp y}|^2+|M_{\perp z}|^2 \end{pmatrix}, \quad (4)$$

$$\sigma\boldsymbol{P''} = \begin{pmatrix} -2\Im(M^*_{\perp y}\cdot M_{\perp z}) \\ 0 \\ 0 \end{pmatrix}, \quad (5)$$

$$\sigma = |\boldsymbol{M}_\perp|^2 + P_{0x}2\Im(M^*_{\perp y}\cdot M_{\perp z}). \quad (6)$$

Here $\boldsymbol{M}_\perp$ is the magnetic interaction vector defined as $\mathbf{M}_\perp = \hat{\mathbf{Q}} \times (\rho(\mathbf{Q}) \times \hat{\mathbf{Q}})$, where $\rho(\mathbf{Q}) = -\mathbf{2}\mu_\mathbf{B}\int\rho(\mathbf{r})\exp(\mathbf{iQ}\cdot\mathbf{r})\mathbf{dr}$ is the Fourier transform of the magnetization density $\rho(\mathbf{r})$ of the investigated sample and $\hat{\mathbf{Q}}$ is a unit vector parallel to the scattering vector $\mathbf{Q}$. The set of polarization axes is defined to have x parallel to $\mathbf{Q}$, z perpendicular to the scattering plane and y completing the right-handed set. We note, that the term $2\Im(M^*_{\perp y}\cdot M_{\perp z}) \equiv C$ is only non-zero for magnetic structures that display chirality and is therefore often denoted as the chiral term. Finally, the measured quantity is the polarization matrix, namely the components of the final polarization vector after the scattering process for all three directions of the incident beam polarization,

$$\mathrm{P}_{ij} = (P_{i0}\tilde{P}_{ji} + P''_j), \quad (7)$$

where i and j ($i,j = x,y,z$) denote the directions of the incident and final polarization vectors, respectively.