LORENTZ INVARIANCE OF THE D'ALEMBERT EQUATION IN VACUO

$$A'_\mu = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & \gamma & i\gamma\beta \\ 0 & 0 & -i\gamma\beta & \gamma \end{bmatrix} \begin{bmatrix} A_X \\ A_Y \\ A_Z \\ iA_0 \end{bmatrix} = \begin{bmatrix} A_X \\ A_Y \\ \gamma A_Z - \gamma\beta A_0 \\ -i\gamma\beta A_Z + i\gamma A_0 \end{bmatrix}$$

$$\Box = \frac{\partial^2}{\partial X^2} + \frac{\partial^2}{\partial Y^2} + \frac{\partial^2}{\partial Z^2} - \frac{1}{c^2}\frac{\partial^2}{\partial t^2} = \Box'$$

$$\Box A_\mu = 0; \qquad \Box A_X = 0; \qquad \Box A_Y = 0; \qquad \Box A_Z = 0; \qquad \Box A_0 = 0$$

$$\begin{aligned} \Box A'_X &= \Box A_X = 0 \\ \Box A'_Y &= \Box A_Y = 0 \\ \Box A'_Z &= \Box(\gamma A_Z - \gamma\beta A_0) = 0 \\ \Box(-\gamma\beta A_Z + \gamma A_0) &= \Box A'_0 = 0 \end{aligned}$$

$$\Box' A'_\mu = \Box A_\mu = 0$$

$$\boldsymbol{A}^{(1)} = \boldsymbol{A}^{(1)'}; \qquad \boldsymbol{A}^{(2)} = \boldsymbol{A}^{(2)'}$$

$$\boldsymbol{B}^{(3)} = \boldsymbol{B}^{(3)'}$$