Typos, Errata and Additions Essential Graduate Electrodynamics Lecture Notes Bernd Berg, Fall 2016

p.11: After equation (1.38):

By reasons that will become clear in the later physical interpretation the variable ζ is called *rapidity*. For each value of d there is precisely one value of ζ and vice versa, because the hyperbolic sine performs a one to one mapping. Such a function is called *isomorphic* in calculus.

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Using finally $\begin{pmatrix} x^0 \\ x^1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$ yields

$$\begin{aligned} 0 &= [\cosh(\zeta) - \sinh(\eta)]^2 - [-\sinh(\zeta) + \cosh(\eta)]^2 \\ &= -2\cosh(\zeta)\sinh(\eta) + 2\sinh(\zeta)\cosh(\eta) \\ &= -2\tanh(\eta) + 2\tanh(\zeta) \;\Rightarrow\; \zeta = \eta\,. \end{aligned} \tag{1.41}$$

p.28:

Consequently, we have

$$\lambda' = \lambda\sqrt{\frac{1+\beta}{1-\beta}} = \lambda\sqrt{\frac{\cosh\zeta + \sinh\zeta}{\cosh\zeta - \sinh\zeta}} = \lambda\,\exp(\zeta)\,. \tag{1.130}$$

p.70:

$$Y_l^{\;-l} \;=\; \sqrt{\frac{(2l+1)\,(2l)!}{4\pi}}\,\frac{\sin^l\theta}{2^l\,l!}\,e^{-il\phi}\,. \tag{2.154}$$

p.77:

The traceless *quadrupole* tensor is defined by

$$Q^{ij} = Q^{ij}_S - Q^{ij}_D \text{ with } Q^{ij}_S = 3\int x'^i x'^j \rho(\vec{x}\,')\,d^3x'\,,\;\; Q^{ij}_D = \int r'^2\,\delta^{ij}\,\rho(\vec{x}\,')\,d^3x' \tag{3.10}$$

so that $\sum_{i=1}^3 Q^{ii}_S = \sum_{i=1}^3 Q^{ii}_D$ holds.

p.80:

$$\Phi(\vec{x}\,) = \frac{\rho(\vec{x}^{\,\prime}\,)}{|\vec{x} - \vec{x}^{\,\prime}\,|} + \frac{\vec{p}(\vec{x}^{\,\prime}\,) \cdot (\vec{x} - \vec{x}^{\,\prime}\,)}{|\vec{x} - \vec{x}^{\,\prime}\,|^3}\,. \tag{3.22}$$

p.101:

Faraday's Law law of induction

$$\epsilon_{\rm emf} = \oint_C \left(\vec{E} + \vec{\beta} \times \vec{B}\right) \cdot d\vec{l} = -\frac{1}{c}\frac{d}{dt}\Phi_m \quad \text{with} \quad \Phi_m = \int_S \vec{B} \cdot d\vec{a}\,, \tag{4.4}$$

p.102:

$$\nabla \cdot \vec{B} \;=\; 0\,, \tag{4.7}$$

which implies due to Gauss' theorem that the flux through a closed surface is zero.

p.183:

$$v_g = \frac{d\omega}{dk_q} = \frac{c}{\sqrt{\mu\epsilon}}\,\frac{d}{dk_q}\,\sqrt{k_q^2 + \gamma_q^2} = \frac{c}{\sqrt{\mu\epsilon}}\,\frac{k_q}{\sqrt{k_q^2 + \gamma_q^2}} < \frac{c}{\sqrt{\mu\epsilon}} \tag{6.48}$$

p.190:

$$\vec{E}_t = \frac{1}{2}\,(\vec{E}_t^+ + \vec{E}_t^-\,) \;=\; -\sin(kz)\frac{k}{\gamma^2}\,\nabla_t\psi(x,y) \tag{6.70}$$

p.212:

$$\vec{E}_{\rm in} \;=\; \hat{\epsilon}_{\rm in}\,E_{\rm in}\,e^{ik_{\rm in}\hat{k}_{\rm in}\cdot\vec{x}}\;, \qquad \vec{B}_{\rm in} \;=\; \hat{k}_{\rm in} \times \vec{E}_{\rm in} \tag{7.87}$$

p.242:

The equation

$$\begin{aligned} 0 &= L_-\, Y_l^{\;-l} \;=\; L_-\, P_l^{\;-l}\, e^{-i\,l\,\phi} \\ &= e^{-i\,\phi}\, \left(-\frac{\partial}{\partial\theta} + i\, \cot\theta\, \frac{\partial}{\partial\phi} \right)\, P_l^{\;-l}\, e^{-i\,l\,\phi}\ , \end{aligned}$$

p.256:

(3) Show that

$$\begin{aligned} \epsilon_{\alpha\beta_1\gamma_1\delta_1}\epsilon^{\alpha\beta_2\gamma_2\delta_2} \;&= -\delta_{\beta_1}^{\;\beta_2}\delta_{\gamma_1}^{\;\gamma_2}\delta_{\delta_1}^{\;\delta_2} - \delta_{\beta_1}^{\;\gamma_2}\delta_{\gamma 1}^{\;\delta_2}\delta_{\delta_1}^{\;\beta_2} - \delta_{\beta_1}^{\;\delta_2}\delta_{\gamma_1}^{\;\beta_2}\delta_{\delta_1}^{\;\gamma_2} \\ &+ \delta_{\beta_1}^{\;\beta_2}\delta_{\gamma_1}^{\;\delta_2}\delta_{\delta_1}^{\;\gamma_2} + \delta_{\beta_1}^{\;\delta_2}\delta_{\gamma_1}^{\;\gamma_2}\delta_{\delta_1}^{\;\beta_2} + \delta_{\beta_1}^{\;\gamma_2}\delta_{\gamma_1}^{\;\beta_2}\delta_{\delta_1}^{\;\delta_2}\,. \end{aligned}$$

p.285:

(4) Use the limit of figure E.8 to calculate the principal value integral defined by

$$\begin{aligned} \frac{1}{2\pi i}\, P \int_{-\infty}^{\infty} dx\, \frac{f(x)}{x-\omega_R} &= \frac{1}{2\pi\, i}\, \lim_{\eta\to 0^+} \left[\int_{-\infty}^{\omega_R-\eta} \frac{f(x)\, dx}{x-\omega_R} + \int_{\omega_R+\eta}^{+\infty} \frac{f(x)\, dx}{x-\omega_R} \right] \\ &=\; \frac{1}{2\pi\, i}\, \lim_{\eta\to 0^+} \left[\int_{-\infty}^{\omega_R+i\eta-\eta} \frac{f(z)\, dz}{z-\omega_R-i\eta} + \int_{\omega_R+i\eta+\eta}^{+\infty} \frac{f(z)\, dz}{z-\omega_R-i\eta} \right] \end{aligned}$$