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Corrigendum

On the validity of the Lorentz–Dirac equation

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The expression (3.3) for the mixed spacetime components of the angular momentum tensor carried by the electromagnetic field of an arbitrarily moving point charge e contains the non-covariant radiative term

$$\frac{4}{3}e^2\int_{-\infty}^{t}\mathrm{d}u\frac{v^i(u)(\mathbf{a}\cdot\mathbf{v})}{\sqrt{1-\mathbf{v}^2}}. \tag{0.1}$$

It is involved in the expression (3.7) for the 'centre-of-mass' conserved quantity **K** which arises from the invariance of the composite particle plus field system under Lorentz transformation. Differentiation of **K** with respect to time leads to the expression (3.11) which contradicts the well-known Lorentz–Dirac equation.

The troubles are caused by the lack of splitting of the angular momentum tensor density into the bound and radiative parts (see López C A and Villarroel D 1975 *Phys. Rev.* D **11** 2724). The bound and the radiative terms are mixed up in equations (3.3), (3.7) and (3.11) of our previous paper. Having used the López and Villarroel splitting we arrive at the correct expression for the spacetime components of the angular momentum:

$$K^i_{\mathrm{em}} := -M^{0i}_{\mathrm{em}} = -\frac{2}{3}e^2\lim_{u\to t}\left[u\frac{v^i(u)}{1-v^2(u)}\frac{1}{t-u} - z^i(u)\left(-\frac{1}{4}+\frac{1}{1-v^2(u)}\right)\frac{1}{t-u}\right] + \frac{2}{3}e^2\int_{-\infty}^{t}\mathrm{d}u\,\mathbf{a}^2(u)[z^i(u)-v^i(u)u] - \frac{2}{3}e^2\int_{-\infty}^{t}\mathrm{d}u\frac{\dot{v}^i(u)}{1-\mathbf{v}^2(u)}. \tag{0.2}$$

As a consequence the covariant radiative term

$$-\frac{2}{3}e^2\int_{-\infty}^{t}\mathrm{d}u\frac{\dot{v}^i(u)}{1-\mathbf{v}^2(u)} = -\frac{2}{3}e^2\int_{-\infty}^{t}\mathrm{d}u[a^i(u)-v^i(u)a^0(u)] \tag{0.3}$$

should be substituted for the last term in equation (3.7) of the previous paper.

Time differentiation of the correct 'centre-of-mass' conserved quantity **K** gives the following expression:

$$p^i_{\mathrm{part}} - v^i(t)p^0_{\mathrm{part}} = -\tfrac{2}{3}e^2[a^i(t)-v^i(t)a^0(t)]. \tag{0.4}$$

It agrees with the structure of the Lorentz–Dirac equation.