

MR2355085 (2008k:78015) 78A35**Yaremko, Yuriy [Yaremko, Yu. G.] (UKR-AOS-CDM)****Radiation reaction in $2 + 1$ electrodynamics. (English summary)***J. Math. Phys.* **48** (2007), no. 9, 092901, 41 pp.

This paper aims to derive the relativistic Lorentz-Dirac equation, complete with radiation reaction, for a particle in $2 + 1$ -dimensional Minkowski space-time. The method is to compute the electromagnetic field momenta—linear and angular—passing through a surface at infinity, and then to relate that to the local renormalized momenta of the particle. The author reminds us that it is to be expected from earlier work by D. V. Gal'tsov [Phys. Rev. D **66** (2002), no. 2, 025016, 5 pp.] that the resulting equation in $2 + 1$ dimensions will not be simply third-order in proper time (as it is in $3 + 1$ dimensions), but will contain an additional ‘tail’ term that involves integration over the historical world-line.

Computation of the stress-energy tensor in terms of the potentials is given relatively simply. The energy-momentum 3-vector ($2 + 1$) and angular momentum tensor are computed by integration over a hypersurface of codimension 1 (i.e., having $2 + 1 - 1 = 2$ dimensions) of the stress-energy tensor and its first moment, respectively. That calculation involves some very complicated analysis, most of which is given in the 7 appendices. Careful treatment is required to determine the correct separation of the renormalizable and non-renormalizable components, and contributions to the integration from the particle world-line itself.

In the end the result, the Lorentz-Dirac equation in $2 + 1$ dimensions, is very simple, being the familiar form from $3 + 1$ dimensions with an extra ‘tail’ term, leading one to wonder if there might be a less arduous route to the same goal.

Reviewed by *Michael Ibison*

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