Corrigendum

A rigorous derivation of gravitational self-force
S E Gralla and R M Wald 2008 Class. Quantum. Grav. 25 205009

Received 29 April 2011, in final form 3 May 2011
Published 27 June 2011

We correct some trivial computational errors as well as an oversight in the statement of our assumptions. The only affected result is the formula for the motion in a non-Lorenz gauge, which takes a simpler form than claimed.

Following is a list of errors and their corrections.

- The uniformity condition stated that $g_{\mu\nu}(\lambda)$ was jointly smooth in $(\alpha, \beta)$ at fixed $(t, \theta, \phi)$. Instead, we should have stated that $g_{\mu\nu}(\lambda)$ is jointly smooth in all variables. This is needed to ensure that the $(g_{\mu\nu})_{nm}$ in equation (23) is smooth in its arguments, as used in much of the analysis of the paper.

- The coordinate freedom allowed by our assumptions was not analyzed adequately. We give a more detailed treatment in [1]. This analysis supports (but does not prove) our claim below (21), and gives the detailed form implied by that claim. In particular, the gauge transformations considered in the appendix are shown to follow from the claim below (21).

- In equation (53) the second term on the right-hand side should be added instead of subtracted.

- In equation (60) the bar and hat were left off an $x_i$.

- In equation (71) the terms in parentheses should be $(3/2)\eta_{\mu\nu} - (1/2)t_{\mu}t_{\nu}$. This error propagates to equations (80), (83), (84) and (86), but does not propagate any further.

- In equation (78) and also in the above text, the spin term should have a factor of 2 in front.

- In equation (78) and also in the above text, the spin terms in equations (80), (83), (84), (86), (87), and elsewhere in the text in this section should have factors of $-4$ in front. This error does not propagate beyond (87); the correct numerical factor was used in all computations.

- In equation (83) the term $A_{\alpha, \beta}$ should be symmetrized, $A_{(\alpha, \beta)}$.

- The second term in equation (A1) should have a factor of $\frac{1}{2}$.

- Equation (A2) should read

$$\delta g_{ab}^{(2)} = \xi^c \nabla_c g_{ab}^{(1)} + 2\nabla_a \xi^c g_{bc}^{(1)} + \xi^c \nabla_c (\xi g_{bc}) + \nabla (\xi g_{bc}) \xi_c + \nabla_c \xi (\nabla_b \xi) \xi_c.$$

Correspondingly, equation (A5) should read

$$\delta g_{00}^{(2)} = \xi^c \nabla_c g_{00}^{(1)} + 2\nabla_0 \xi^c g_{0c}^{(1)} + \xi^c \nabla_c (\xi g_{00}) + \nabla (\xi g_{00}) \xi_c + \nabla_c \xi (\nabla_0 \xi) \xi_c.$$

- Equation (A6) should not have the ‘$-1$’ term.

- Equations (A7) and (A11) should not have $\chi$ terms; equivalently, (A8) should read $\chi = 0$.

References

[1] Gralla S E and Wald R M 2011 A note on the coordinate freedom in describing the motion of particles in general relativity arXiv:1104.5305 [gr-qc]