Erratum: 2.5PN linear momentum flux from inspiralling compact binaries in quasicircular orbits and associated recoil: Nonspinning case [Phys. Rev. D 85, 044021 (2012)]

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In the first footnote of the present work we had pointed out (based on a private communication of results available then) that the coefficient “−484/105” appearing at the 2.5PN order in the expression for \( J_{ij} \) in Eq. (5.15b) of Ref. [1] was incorrect and to be replaced by “−148/35.” This was taken into account while writing Eq. (3.2a) of the present work. However, recently it was pointed out in the erratum of Ref. [1] that, the coefficient “−484/105” should be replaced by “−188/35” not by “−148/35” as assumed in the footnote of the this work. This shall lead to changes in the expression for \( J_{ij} \) [Eq. (3.2a)], instantaneous part of the linear momentum flux [Eqs. (3.12) and (3.13)], total linear momentum flux [Eq. (3.23)], and recoil velocity [Eqs. (4.6) and (5.1)].

Independent and in addition to the above, in Sec. IV , while computing the contribution to the recoil velocity at 2.5PN [Eq. (4.6)], it was argued that the total loss of linear momentum during the inspiral phase can simply be obtained by replacing \( \hat{n}^i \) by \( -\hat{\lambda}^i / \omega \) and \( \hat{\lambda}^i \) by \( \hat{n}^i / \omega \) in Eq. (3.23). This follows from the constancy of \( \omega \) at 2PN in Eqs. (4.4a) and (4.4b). Although, at 2PN order Eq. (4.4) is a correct approximation, at 2.5PN order (the accuracy of results in the present work) this does not hold and has to be modified by inclusion of the secular evolution of the orbital frequency (\( \omega \)). Thus Eq. (4.4) should read as

\[
\int_{-\infty}^{t} \omega^{11/3} \hat{n}^i dt' = \int_{-\infty}^{t} \omega^{8/3} \frac{d\hat{\lambda}^i}{dt'} dt' = -\omega^{8/3} \left[ \hat{\lambda}^i - \frac{8}{3} \frac{\dot{\omega}}{\omega^2} \hat{n}_i \right].
\]

\[
\int_{-\infty}^{t} \omega^{11/3} \hat{\lambda}^i dt' = \int_{-\infty}^{t} \omega^{8/3} \frac{d\hat{n}^i}{dt'} dt' = \omega^{8/3} \left[ \hat{n}^i + \frac{8}{3} \frac{\dot{\omega}}{\omega^2} \hat{\lambda}_i \right].
\]

Here, \( \dot{\omega} \) and \( \omega \) are given by Eq. (3.7b) and Eq. (3.9), respectively.

This leads to corrections to the coefficients at the 2.5PN order in Eq. (4.6) [and hence to Eq. (5.1)]. The above two considerations lead to the following changes in the paper:

(i) Equation (3.2a), coefficient of \( \xi \gamma^2 \nu \epsilon_{ab}(\nu_{j}a_{x}b) \)

\[
-\frac{148}{35} \rightarrow -\frac{188}{35}.
\]

(ii) Equation (3.12), in the last line, coefficient of \( \gamma^{5/2} \nu \hat{n}_i \)

\[
\frac{1199}{290} \rightarrow \frac{3437}{870}.
\]

(iii) Equation (3.13), in the last line, coefficient of \( \gamma^{5/2} \nu \hat{\lambda}_i \)

\[
\frac{1199}{290} \rightarrow \frac{3437}{870}.
\]

(iv) Equation (3.23), in the second line, coefficient of \( \gamma^{5/2} \nu \hat{\lambda}_i \)

\[
\frac{32698}{12615} \rightarrow \frac{10126}{4205}.
\]

(v) Equation (4.6), in the second line, coefficient of \( \gamma^{5/2} \nu \hat{\lambda}_i \)
Although with modified expressions for the recoil velocity, changes in the recoil velocity estimates at the innermost stable circular orbit are as large as 21%, changes in our final estimates for the recoil velocity at the end of the plunge phase are less than 1.3% since the final recoil velocity estimates are dominated by the plunge phase results. For instance, with corrected expressions for the recoil velocity, we find that for a binary with symmetric mass ratio ($\nu$) of 0.2, the recoil velocity estimates at the end of ISCO changes from $3.97 \text{ kms}^{-1}$ to $4.55 \text{ kms}^{-1}$; however, the recoil velocity at the end of the plunge changes from earlier estimates of $\sim 181.1(177.5) \text{ kms}^{-1}$ to $\sim 179.5(179.5) \text{ kms}^{-1}$ when method 1 (method 2 with $\alpha = 0.1$) is used. Similarly though various numerical estimates for the recoil velocity quoted in the published version will involve changes, we do not provide them since their magnitudes are small. However, we replace Fig. 1 of the paper in order to make it consistent with the new estimates.

Finally, we would like to correct the following two typographical errors in the published version of the present work:

(i) Figure 1, the label of the fifth legend from the top (orange-long-dashed-line), should read M2; $\alpha = 0.5$ instead of M2; $\alpha = 0.05$. This has already been taken into account in the new figure appearing here.

(ii) Page 044021-13, 1st column, text in the seventh line; 17 kms$^{-1}$ in the text was actually meant to be 171 kms$^{-1}$.

However, it changes to the new estimate of 172 kms$^{-1}$.