Gravitational-wave tails of tails

Corrigendum

Gravitational-wave tails of tails

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The contribution of tails in the flux of gravitational waves $\mathcal{L}$ from compact binaries at 3.5PN order has been incorrectly computed. The tails at this order arise from interaction between the mass monopole moment M of the source and higher-order multipole moments. When replacing these moments into equation (4.19) in the case of compact binary systems it was incorrectly assumed that the mass M is just given by the sum of the rest masses, $m = m_1 + m_2$. However M is in fact given by the ADM mass of the binary and should involve relativistic corrections. The same error has been made for the tails at relative 2.5PN order in [1]. At relative 2PN order we have (using the notation of the paper)

$$M = m \left[1 - \frac{\nu}{2}\gamma + \frac{\nu}{8}(7 - \nu)\gamma^2 + \mathcal{O}\left(\frac{1}{c^6}\right) \right]. \tag{1}$$

These corrections affect the tails at 2.5PN and 3.5PN orders for compact binaries. As a result equations (5.5*a*) and (5.5*b*) are changed to

$$\mathcal{L}_{\text{tail}} = \frac{32c^5}{5G}\nu^2\gamma^5 \left\{ 4\pi\gamma^{3/2} - \left(\frac{25663}{672} + \frac{125}{8}\nu \right)\pi\gamma^{5/2} \right.$$
$$\left. + \left(\frac{90205}{576} + \frac{505747}{1512}\nu + \frac{12809}{756}\nu^2 \right)\pi\gamma^{7/2} + O(\gamma^4) \right\}, \tag{2}$$

$$\mathcal{L}_{\text{tail}} = \frac{32c^5}{5G}\nu^2 x^5 \left\{ 4\pi x^{3/2} - \left(\frac{8191}{672} + \frac{583}{24}\nu \right)\pi x^{5/2} \right.$$
$$\left. + \left(-\frac{16285}{504} + \frac{214745}{1728}\nu + \frac{193385}{3024}\nu^2 \right)\pi x^{7/2} + O(x^4) \right\}. \tag{3}$$

The tails-of-tails at 3PN order are not modified.

References

[1] Blanchet L 1996 *Phys. Rev.* D **54** 1417 (*Preprint* gr-qc/9603048)