IOP Publishing Classical and Quantum Gravity
Class. Quantum Grav. **37** (2020) 109501 (2pp) https://doi.org/10.1088/1361-6382/ab79d4

Corrigendum

Corrigendum: Inspiral into Gargantua (2016 *Class. Quantum Grav.* **33** 155002)

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Received 30 January 2020, revised 17 February 2020
Accepted for publication 25 February 2020
Published 16 April 2020

Our analysis of the change in black hole spin during near-horizon inspiral (section 2.3) was incorrect due to a computational error. The affected equations are (23)–(25), which we repeat here:

$$\frac{\mathrm{d}\epsilon}{\mathrm{d}t} = \frac{0.102}{M}\frac{\mu^2}{M^2}x_0 \tag{23–old}$$

$$\Delta\epsilon_{\mathrm{total}} < 0.046\frac{\mu}{M}(X_0 - 2^{1/3}\epsilon^{2/3}) \tag{24–old}$$

$$\Delta\left[\frac{a}{M}\right]_{\mathrm{total}} < 10^{-3}X_0^2\frac{\mu^2}{M^2}. \tag{25–old}$$

It is more convenient to present the corrected results in terms of $\epsilon^2 = 1 - (a/M)^2 \approx 2(1 - a/M)$, where $\epsilon \ll 1$. Using the same method described in the text and fixing the computational error, we instead find

$$\frac{\mathrm{d}\epsilon^2}{\mathrm{d}t} = \frac{0.399}{M}\frac{\mu^2}{M^2}x_0^2 \tag{23–new}$$

$$\Delta\left[\epsilon^2\right]_{\mathrm{total}} < 0.090\frac{\mu}{M}X_0^2\left(1 - \frac{2^{2/3}\epsilon^{4/3}}{X_0^2}\right) \tag{24–new}$$

$$\Delta\left|\frac{a}{M}\right|_{\mathrm{total}} < 0.045\frac{\mu}{M}X_0^2. \tag{25–new}$$

The most important difference is that the change in spin is now linear in the mass ratio, as opposed to quadratic. Note also that the new left-hand-side of (25) now correctly refers to the absolute value of a/M, which is necessary since a/M decreases during near-horizon inspiral. We thank Geoffrey Compère for pointing out these errors—see also reference [1].

The change in spin over the near-horizon inspiral is significantly larger than originally calculated, meaning that there is a smaller range of mass-ratios over which the near-horizon inspiral can occur (without spinning down the black hole such that the near-horizon region no longer exists). We may estimate this range based on the observation (section 3.1) that near-horizon inspiral is visible in the waveform for $a \gtrsim 0.9999M$ with a starting radius of $X_0 \approx 0.3$. Demanding $\Delta|a/M|_{\text{total}} < 0.0001$ using $X_0 = 0.3$, the new version of (25) gives the bound $\mu/M < 0.025$. Thus near-horizon inspiral remains consistent for both the LIGO and LISA sources discussed in the appendix (with mass ratios of order 10^{-3} and smaller), and our main conclusions about observability are unmodified.

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Reference

[1] Compère G, Fransen K and Jonas C 2019 arXiv:1909.12848 [gr-qc]