**Erratum: Strong-field tidal distortions of rotating black holes:
Formalism and results for circular, equatorial orbits
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Stephen O’Sullivan and Scott A. Hughes
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While working on a followup analysis to this paper, we have found four typographical errors in its appendixes. We have also learned that there is long-hidden error in this paper’s Ref. [10] (Ref. [1] in this erratum), which has a small impact on some of the numbers which we present.

We begin by cataloging the typographical errors. First, the text following Eq. (B71) should read “The sums over l and ℓ are taken from $\max(2, |m|)$ to ∞ ; the sums over k and n are both taken from $-\infty$ to ∞ .” In the published version of this paper, we wrote “min” rather than “max.”

Next, Eqs. (B77) and Eq. (B78) are only correct for equatorial orbits—i.e., orbits for which the polar index k can be neglected. These equations are, however, not needed for any other part of our analysis. Indeed, they could (and probably should) have been omitted from the paper altogether. In particular, Eq. (B79) is correct, independent of Eqs. (B77) and (B78).

Equation (B80) should read

$$\begin{aligned}\varepsilon_{\ell m} &= -i\varepsilon_{\ell m}^c & m \neq 0 \\ &= \text{Im}\varepsilon_{\ell m}^c & m = 0.\end{aligned}$$

As published, we wrote the wrong sign on the second line. This error is obvious by inspection since it is inconsistent with the first line.

Equation (C3) should read

$${}_sS_{lm}(\theta) = {}_sY_{lm}(\theta) + (a\omega){}_sS_{lm}^1(\theta).$$

In the published paper, we wrote ${}_sY_{lm}^1(\theta)$ rather than ${}_sS_{lm}^1(\theta)$ in this equation. We then wrote ${}_sS_{lm}^1(\theta)$ in all subsequent relevant equations.

None of these typographical errors has propagated into our code, so they have no impact on our results. A more important error has recently been brought to our attention by Éanna Flanagan. In our analysis, the on-horizon tidal field ψ_0 is computed by first calculating the field ψ_4 and then using the Starobinsky-Churilov identities. This identity makes use of the complex number c_{lmkn} given in our paper’s Eqs. (2.21)–(2.23). Our published paper gives the incorrect sign for the imaginary part of c_{lmkn} : Eq. (2.22) should read

$$\text{Im}c_{lmkn} = 12PM\omega_{mkn},$$

where $P = (-1)^{l+k+m}$. It is positive for polar modes ($l + k + m$ even), and negative for axial modes ($l + k + m$ odd). This error originates in Eq. (3.25) of Ref. [1]. Chrzanowski *et al.* [2] seem to be implicitly aware that this number’s value must differ for polar and axial modes [cf. their Eqs. (3.16)–(3.18)]. Bardeen also discussed this error at a talk given at the 2007 Eastern Gravity Meeting [3], and described it in an unpublished manuscript [4] he circulated among some of the meeting’s participants. Flanagan and Hinderer have since found a straightforward derivation of the error which confirms Bardeen’s findings, and which will appear elsewhere [5].

This error has a small impact on some of our numerical results—all of the cases for which $l + m$ is odd are in principle affected. However, for circular and equatorial orbits, the leading impact of the imaginary part of c_{lmkn} on our results enters at order $a\Omega_{\text{orb}}$. As such, the effects are non-negligible only for large spin, strong-field orbits; even in that limit, the effects are quite small. The simplest way to account for the effect of this error is by recomputing the angle at which the horizon’s bulge is largest. Equation (4.46), listing the bulge angles for $q = 0.1$, becomes

$$\begin{aligned}
\delta\psi^{\text{num}} &= 3.01^\circ & r_o &= 50M, \\
&= 10.8^\circ & r_o &= 20M, \\
&= 21.6^\circ & r_o &= 10M, \\
&= 33.8^\circ & r_o &= 5.669M.
\end{aligned}$$

These values are unchanged from what we published, except at $r_o = 5.669M$, where the angle increases by 0.1° . Equation (4.48) becomes

$$\begin{aligned}
\delta\psi^{\text{num}} &= -13.5^\circ & r_o &= 50M, \\
&= -6.17^\circ & r_o &= 20M, \\
&= 3.56^\circ & r_o &= 10M, \\
&= 21.5^\circ & r_o &= 4.614M;
\end{aligned}$$

in this case, the angle at $r_o = 10M$ is increased by 0.01° , and at $r_o = 4.614M$ by 0.1° .

These changes must also be applied to the numbers given in our paper's Fig. 5. The figures themselves, however, do not change significantly: the shapes of the distorted horizons are not noticeably modified. This is true even at larger spin values. The numbers given in the left-hand panels of Fig. 6 (data for $q = 0.7$) should be corrected to

$$\begin{aligned}
\delta\psi^{\text{num}} &= -23.0^\circ & r_o &= 50M, \\
&= -16.1^\circ & r_o &= 20M, \\
&= -7.83^\circ & r_o &= 10M, \\
&= 10.6^\circ & r_o &= 3.393M.
\end{aligned}$$

Only the two strongest field results are affected, increasing the angle by 0.04° for $r = 10M$, and by 0.3° for $r = 3.393M$. These data in the right-hand panels of Fig. 6 ($q = 0.866$) become

$$\begin{aligned}
\delta\psi^{\text{num}} &= -24.3^\circ & r_o &= 50M, \\
&= -17.4^\circ & r_o &= 20M, \\
&= -9.50^\circ & r_o &= 10M, \\
&= 6.07^\circ & r_o &= 3.393M.
\end{aligned}$$

Again, only the two strongest field results are affected: an increase of 0.06° for $r = 10M$, and of 0.69° for $r = 2.537M$. Finally, the data in Fig. 8 should be corrected to

$$\begin{aligned}
\delta\psi^{\text{num}} &= -4.9^\circ & a &= 0.1M, & r_o &= 1170M, \\
&= 22.2^\circ & a &= 0.2M, & r_o &= 7.269M, \\
&= 23.2^\circ & a &= 0.3M, & r_o &= 5.451M, \\
&= 22.8^\circ & a &= 0.4M, & r_o &= 4.385M, \\
&= 21.3^\circ & a &= 0.5M, & r_o &= 3.647M, \\
&= 18.8^\circ & a &= 0.6M, & r_o &= 3.078M, \\
&= 15.3^\circ & a &= 0.7M, & r_o &= 2.602M, \\
&= 10.6^\circ & a &= 0.8M, & r_o &= 2.172M.
\end{aligned}$$

Since this figure focuses on rather strong-field orbits, several of the entries must be updated: for $a = 0.4M$ and $a = 0.5M$, the angle is increased by 0.1° ; for $a = 0.6M$, it is increased by 0.3° ; for $a = 0.7M$, it is increased by 0.4° ; and for $a = 0.8M$, it is increased by 0.75° .

- [1] S. A. Teukolsky and W. H. Press, [Astrophys. J.](#) **193**, 443 (1974).
- [2] P. L. Chrzanowski, R. A. Matzner, V. D. Sandberg, and M. P. Ryan, [Phys. Rev. D](#) **14**, 317 (1976).
- [3] J. Bardeen, 2007 Eastern Gravity Meeting, June 2007, Ithaca, NY.
- [4] J. Bardeen (unpublished).
- [5] E. E. Flanagan and T. Hinderer (work in progress).