Erratum: Search for ultralight bosons in Cygnus X-1 with Advanced LIGO [Phys. Rev. D 101, 063020 (2020)]

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This erratum reports a missing coefficient when comparing the numerically estimated signal strain h_0 to the upper limit $h_0^{95\%}$ in Sec. III A of this paper. The numerically estimated signal strain defined in (28) in Ref. [1] differs from the conventional definition of h_0 in continuous-wave literature by a factor of $\sqrt{5/(4\pi)}$ [2].

This missing factor has been corrected in the original Fig. 3 in this paper, as shown in Fig. 1 in this erratum. The thick colored curve shows the corrected estimated h_0, assuming an age of the black hole (BH) $t_{\rm age} = 5 \times 10^6$ yr. The disfavored boson mass range presented in Sec. III A of this paper is hence updated to $6.4 \leq \mu/(10^{-13}\ {\rm eV}) \leq 8.0$, indicated by the dark
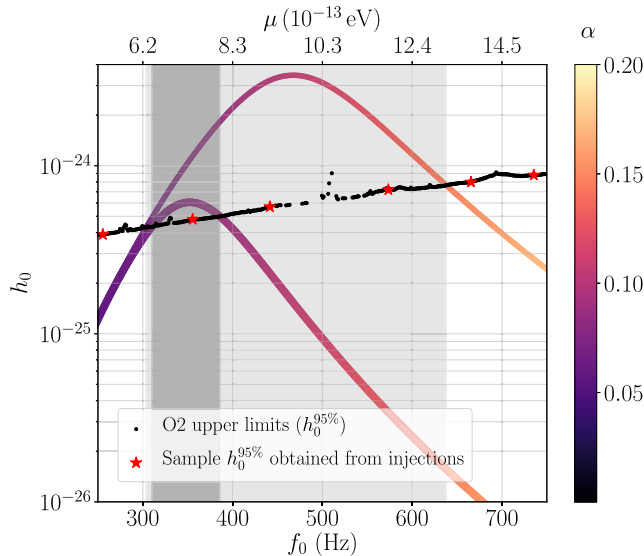

FIG. 1. Frequentist strain upper limits at 95% confidence ($h_0^{95\%}$) and disfavored scalar boson mass range. The colored curves show the numerically estimated signal strain (h_0) as a function of boson mass (top axis) and GW frequency (bottom axis). The thick and thin curves correspond to $t_{\rm age} = 5 \times 10^6$ yr and 1×10^5 yr, respectively. The color stands for the fine-structure constant (α). The black dots indicate $h_0^{95\%}$ obtained from the search, assuming the electromagnetically measured orientation $\iota = 27.1° \pm 0.8°$. The red stars mark $h_0^{95\%}$ obtained through injections in O2 data in six sample 1-Hz sub-bands. Sub-bands without a marker were vetoed. The shaded region marks the parameter space where $h_0^{95\%}$ beats the analytically estimated strain, and hence corresponds to the disfavored boson mass range without a detection: $6.4 \leq \mu/(10^{-13}\ {\rm eV}) \leq 8.0$ for $t_{\rm age} = 5 \times 10^6$ yr and $6.3 \leq \mu/(10^{-13}\ {\rm eV}) \leq 13.2$ for $t_{\rm age} = 1 \times 10^5$ yr. The source parameters adopted in the analytic estimation are $M = 14.8\ M_\odot$, $\chi_i = 0.99$, and $d = 1.86$ kpc.

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shaded region. This is a conservatively disfavored mass range [3], corresponding to a conservative choice of the BH age, $t_{\text{age}} = 5 \times 10^6$ yr. We add an alternative choice of t_{age} and the corresponding results in this erratum. If it is assumed that the BH is not much older than the x-ray binary jet, e.g., $t_{\text{age}} = 10^5$ yr [4], the estimated h_0 is significantly larger for $\mu \gtrsim 6.2 \times 10^{-13}$ eV (thin colored curve), and a wider mass range of $6.3 \leq \mu/(10^{-13}$ eV$) \leq 13.2$ is disfavored (light shaded region).

The correction described in this erratum does not impact the results presented for the string axiverse scenario.

[1] M. Isi, L. Sun, R. Brito, and A. Melatos, Directed searches for gravitational waves from ultralight bosons, Phys. Rev. D **99**, 084042 (2019).

[2] M. Isi, L. Sun, R. Brito, and A. Melatos, Erratum: Directed searches for gravitational waves from ultralight bosons [Phys. Rev. D **99**, 084042 (2019)]; Phys. Rev. D **102**, 049901 (2020).

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[4] D. M. Russell, R. P. Fender, E. Gallo, and C. R. Kaiser, The jet-powered optical nebula of Cygnus X1, Mon. Not. R. Astron. Soc. **376**, 1341 (2007).