

Erratum: Placing limits on the stochastic gravitational-wave background using European Pulsar Timing Array data

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The paper ‘Placing limits on the stochastic gravitational-wave background using European Pulsar Timing Array data’ was published in *Mon. Not. R. Astron. Soc.* **414**, 3117–3128 (2011). Both a factor of 3 and a ‘+’ symbol were missing in equation (6). The correct equation for the covariance matrix of the signal due to a background of gravitational waves (GWB) should be:

$$C_{(ai)(bj)}^{\text{GW}} = \frac{-A^2 \zeta_{ab} \text{yr}^{2\alpha}}{12\pi^2 f_L^{2-2\alpha}} \left\{ \Gamma(-2 + 2\alpha) \cos(\pi\alpha) (f_L \tau)^{2-2\alpha} + \sum_{n=0}^{\infty} (-1)^n \frac{(f_L \tau)^{2n}}{(2n)! (2n + 2\alpha - 2)} \right\}. \quad (6)$$

The correction of this typographical error reflects the definition of the GWB amplitude as it was used in our code which produced the limit on the stochastic background, and as it was used in Jenet et al. (2006) with which we stated our findings to be compatible. Our results therefore remain unchanged.

We also note a correction in the numerical coefficient of equation (10). The correct expression is (Damour & Vilenkin 2005, their equation 4.8):

$$h \approx 9.8 \times 10^{-15} c^{1/2} p^{-1/2} \epsilon_{\text{eff}}^{-1/6} \left(\frac{G\mu}{10^{-6}} \right)^{1/3} \times \left(\frac{f}{\text{yr}^{-1}} \right)^{-7/6} \left(\frac{h}{0.65} \right)^{7/6}, \quad (10)$$

where, besides correcting the numerical coefficient in the original paper, we have used $\Gamma \approx 50$, which is a more realistic scenario than $\Gamma \approx 100$ (Casper & Allen 1995). The error in the numerical coefficient is also present in Jenet et al. (2006). Recalculating the constraint on the string tension from our data and by using $c = p = \epsilon = 1$ and $h = 0.704$, we get

$$G\mu \lesssim 1.2 \times 10^{-8},$$

almost one order of magnitude weaker than our initial result.

This correction resolves a puzzling inconsistency: the excessive discrepancy of two orders of magnitude between results obtained with this analytic approximation and those of more detailed investigations (i.e. Ölmez, Mandic & Siemens 2010; Sanidas, Battye & Stappers 2012). In Sanidas et al. (2012), the authors presented an absolute upper limit on the string tension $G\mu \lesssim 5.3 \times 10^{-7}$, using our limit on the amplitude of the stochastic gravitational wave background and taking into account the uncertainties involved in the cosmic string model parameters. The one order of magnitude difference between our revised constraint and their results is now well justified within the approximations of Damour & Vilenkin (2005). This is discussed in more detail by Sanidas et al. (2012) and has recently been pointed out by Shlaer, Vilenkin & Loeb (2012) as well.

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REFERENCES

- Casper P., Allen B., 1995, *Phys. Rev. D*, 52, 4337
 Damour T., Vilenkin A., 2005, *Phys. Rev. D*, 71, 063510
 Jenet F. et al., 2006, *ApJ*, 653, 1571
 Ölmez S., Mandic V., Siemens X., 2010, *Phys. Rev. D*, 81, 104028
 Sanidas S. A., Battye R. A., Stappers B. W., 2012, *Phys. Rev. D*, 85, 122003
 Shlaer B., Vilenkin A., Loeb A., 2012, *J. Cosmol. Astropart. Phys.*, 5, 26
 van Haasteren R. et al., 2011, *MNRAS*, 414, 3117

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