

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

R. van Haasteren, Y. Levin, G. H. Janssen, K. Lazaridis, M. Kramer, B. W. Stappers, Grégory Desvignes, M. B. Purver, A. G. Lyne, R. D. Ferdman, et al.

► To cite this version:

R. van Haasteren, Y. Levin, G. H. Janssen, K. Lazaridis, M. Kramer, et al.. Erratum: Placing limits on the stochastic gravitational-wave background using European Pulsar Timing Array data. Monthly Notices of the Royal Astronomical Society, Oxford University Press (OUP): Policy P - Oxford Open Option A, 2012, 425 (2), 2 p. 10.1111/j.1365-2966.2012.20916.x . insu-01261990

HAL Id: insu-01261990

<https://hal-insu.archives-ouvertes.fr/insu-01261990>

Submitted on 13 Jan 2017

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

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

by R. van Haasteren,^{*} Y. Levin, G. H. Janssen, K. Lazaridis, M. Kramer, B. W. Stappers, G. Desvignes, M. B. Purver, A. G. Lyne, R. D. Ferdman, A. Jessner, I. Cognard, G. Theureau, N. D'Amico, A. Possenti, M. Burgay, A. Corongiu, J. W. T. Hessels, R. Smits and J. P. W. Verbiest

Key words: errata, addenda – gravitational waves – methods: data analysis – pulsars: general.

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.

ACKNOWLEDGMENTS

The authors thank Paul Demorest and Xavier Siemens for discovering these mistakes in our work. Sotiris Sanidas is thanked for his contributions towards tracing the mistake in the cosmic string tension limit.

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

^{*}E-mail: vhaasteren@gmail.com

This paper has been typeset from a $\text{\TeX}/\text{\LaTeX}$ file prepared by the author.

Copyright of Monthly Notices of the Royal Astronomical Society is the property of Wiley-Blackwell and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.