

Supplementary material to Testing the post-Newtonian expansion with GW170817

Andrey A. Shoom,^{1,*} Pawan K. Gupta,^{2,3,†} Badri Krishnan,^{1,4,‡} Alex B. Nielsen,^{5,1,§} and Collin D. Capano^{1,¶}

¹*Max Planck Institute for Gravitational Physics (Albert Einstein Institute),
Leibniz Universität Hannover, Callinstr. 38, D-30167, Hannover, Germany*

²*Nikhef, Science Park, 1098 XG Amsterdam, The Netherlands*

³*Institute for Gravitational and Subatomic Physics (GRASP),
Department of Physics, Utrecht University, Princetonplein 1, 3584 CC Utrecht, The Netherlands*

⁴*Institute for Mathematics, Astrophysics and Particle Physics,
Radboud University, Heyendaalseweg 135, 6525 AJ Nijmegen, The Netherlands*

⁵*Department of Mathematics and Physics, University of Stavanger, NO-4036 Stavanger, Norway*

* andrey.shoom@aei.mpg.de

† pawan.nf@gmail.com

‡ badri.krishnan@aei.mpg.de

§ alex.b.nielsen@uis.no

¶ collin.capano@aei.mpg.de

The covariance matrix Σ for the non-GR parameters $\{\delta\Psi_n, n = 0, \dots, 4\}$ reads

$$\Sigma = \begin{bmatrix} 0.0000835305432 & -0.0000139534857 & 0.000676505782 & -0.00553549543 & 0.0289240726 \\ -0.0000139534857 & 0.00120607831 & -0.0153216362 & 0.0954850102 & -0.262147965 \\ 0.000676505782 & -0.0153216362 & 0.222164952 & -1.61619631 & 5.74224571 \\ -0.00553549543 & 0.0954850102 & -1.61619631 & 13.8496255 & -55.7900581 \\ 0.0289240726 & -0.262147965 & 5.74224571 & -55.7900581 & 291.739743 \end{bmatrix}.$$

It is diagonalised via the transformation matrix $\mathbf{T}$ as follows: $\hat{\Sigma} = \mathbf{T}^T \cdot \Sigma \cdot \mathbf{T}$, where the transposed transformation matrix $\mathbf{T}^T$ relates the correlated non-GR parameters $\{\delta\Psi_n, n = 0, \dots, 4\}$ to the uncorrelated ones $\{\delta\hat{\Psi}_n, n = 0, \dots, 4\}$ as follows:

$$\begin{bmatrix} \delta\hat{\Psi}_0 \\ \delta\hat{\Psi}_1 \\ \delta\hat{\Psi}_2 \\ \delta\hat{\Psi}_3 \\ \delta\hat{\Psi}_4 \end{bmatrix} = \begin{bmatrix} 0.303039039 & -0.946891529 & -0.107459486 & -0.00400142918 & 0.0004690007051 \\ 0.952968711 & 0.301598330 & 0.0298107605 & 0.000556544273 & -0.000303803136 \\ 0.00423878797 & -0.110587590 & 0.980407508 & 0.162533022 & 0.0116856145 \\ -0.0000121304198 & -0.0142980335 & 0.161178925 & -0.968277962 & -0.190406690 \\ 0.0000973323323 & -0.000911164975 & 0.0196532579 & -0.189748473 & 0.981635587 \end{bmatrix} \cdot \begin{bmatrix} \delta\Psi_0 \\ \delta\Psi_1 \\ \delta\Psi_2 \\ \delta\Psi_3 \\ \delta\Psi_4 \end{bmatrix}.$$

The diagonalised (up to numerical errors) covariance matrix $\hat{\Sigma}$ reads

$$\hat{\Sigma} = \begin{bmatrix} 5.09497535 \times 10^{-6} & -1.53268226 \times 10^{-37} & 5.96049104 \times 10^{-36} & -5.96680932 \times 10^{-35} & 4.81482486 \times 10^{-35} \\ -1.63284708 \times 10^{-37} & 8.78232672 \times 10^{-5} & -8.80725367 \times 10^{-37} & 2.70833898 \times 10^{-35} & -4.81482486 \times 10^{-35} \\ 9.73086865 \times 10^{-36} & -1.21773931 \times 10^{-36} & 2.44039719 \times 10^{-2} & -3.10706667 \times 10^{-34} & -1.54074396 \times 10^{-33} \\ -7.96419859 \times 10^{-35} & 2.43871714 \times 10^{-35} & -4.50273111 \times 10^{-35} & 3.14924944 & -3.08148791 \times 10^{-32} \\ 1.57845824 \times 10^{-34} & -3.61787028 \times 10^{-35} & -4.09372961 \times 10^{-33} & -1.81037415 \times 10^{-32} & 3.02639077 \times 10^2 \end{bmatrix}.$$

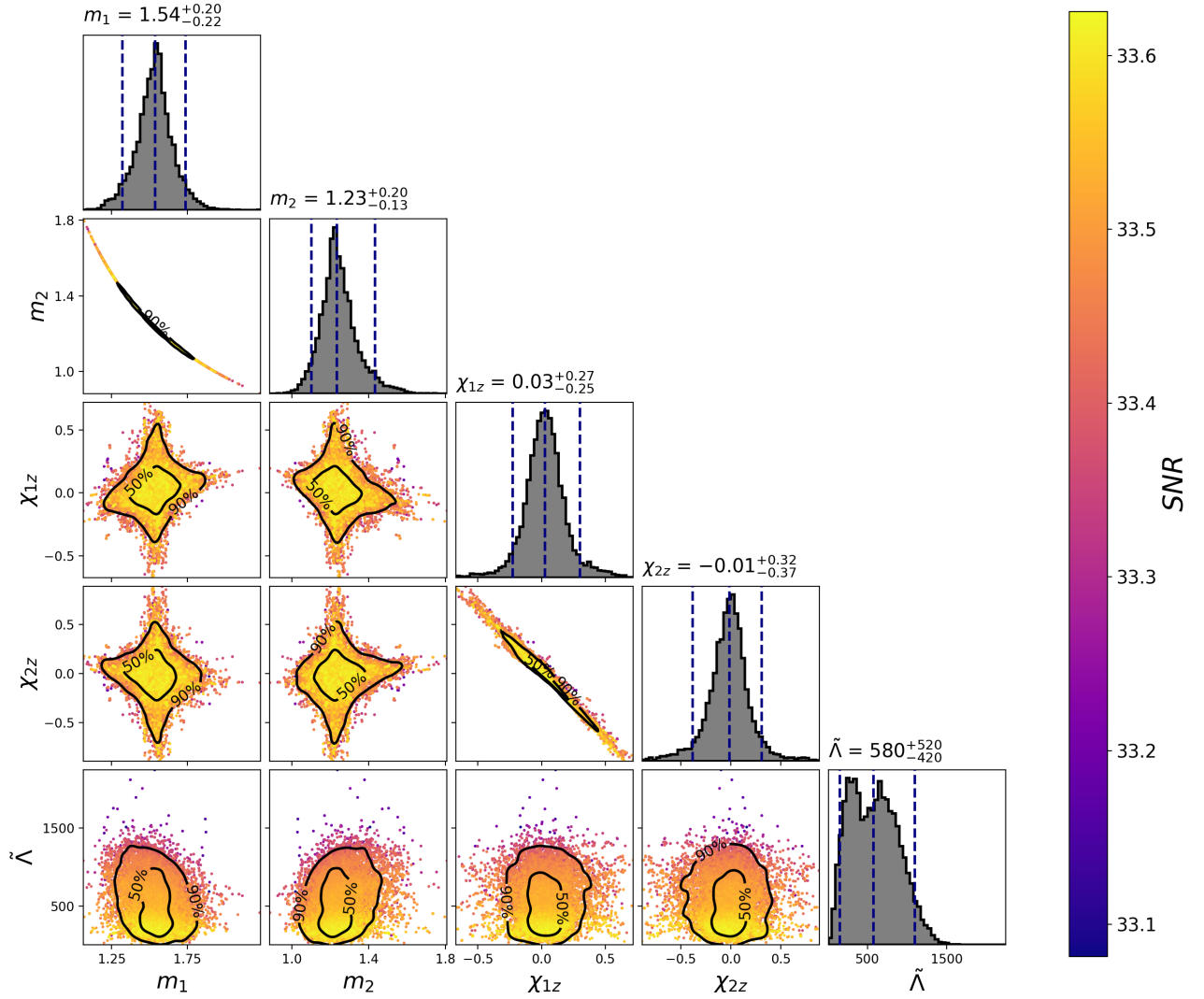


FIG. 1. Posterior density distributions of the binary parameters. The central plots are 2D marginal posteriors, where the black contours show the 50% and 90% credible regions. The upper and the right plots are the 1D marginal posteriors, where the median and 90% credible intervals are indicated by the dashed lines.

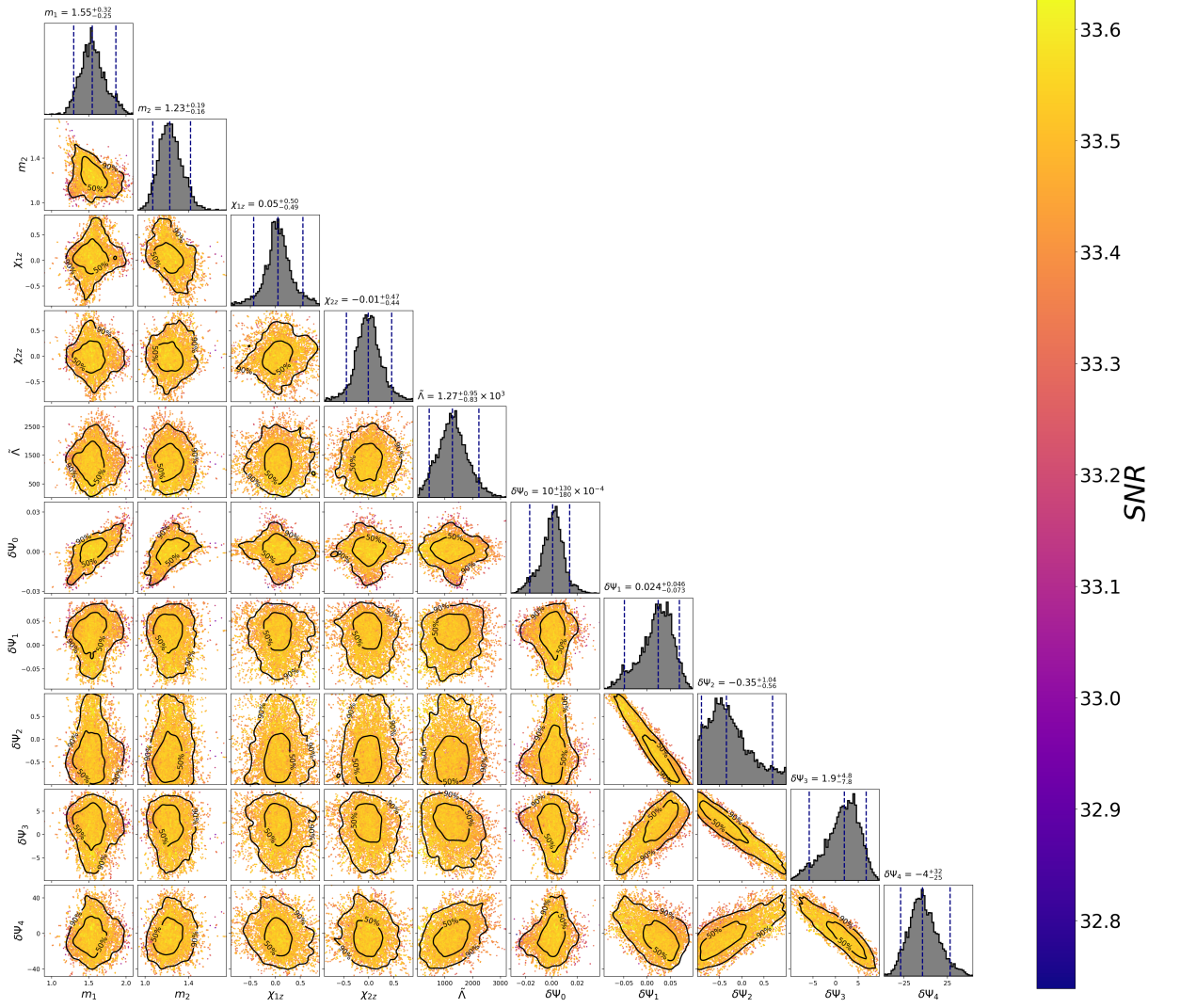


FIG. 2. Posterior density distributions of the binary parameters and the non-GR parameters. The central plots are 2D marginal posteriors, where the black contours show the 50% and 90% credible regions. The upper and the right plots are the 1D marginal posteriors, where the median and 90% credible intervals are indicated by the dashed lines.

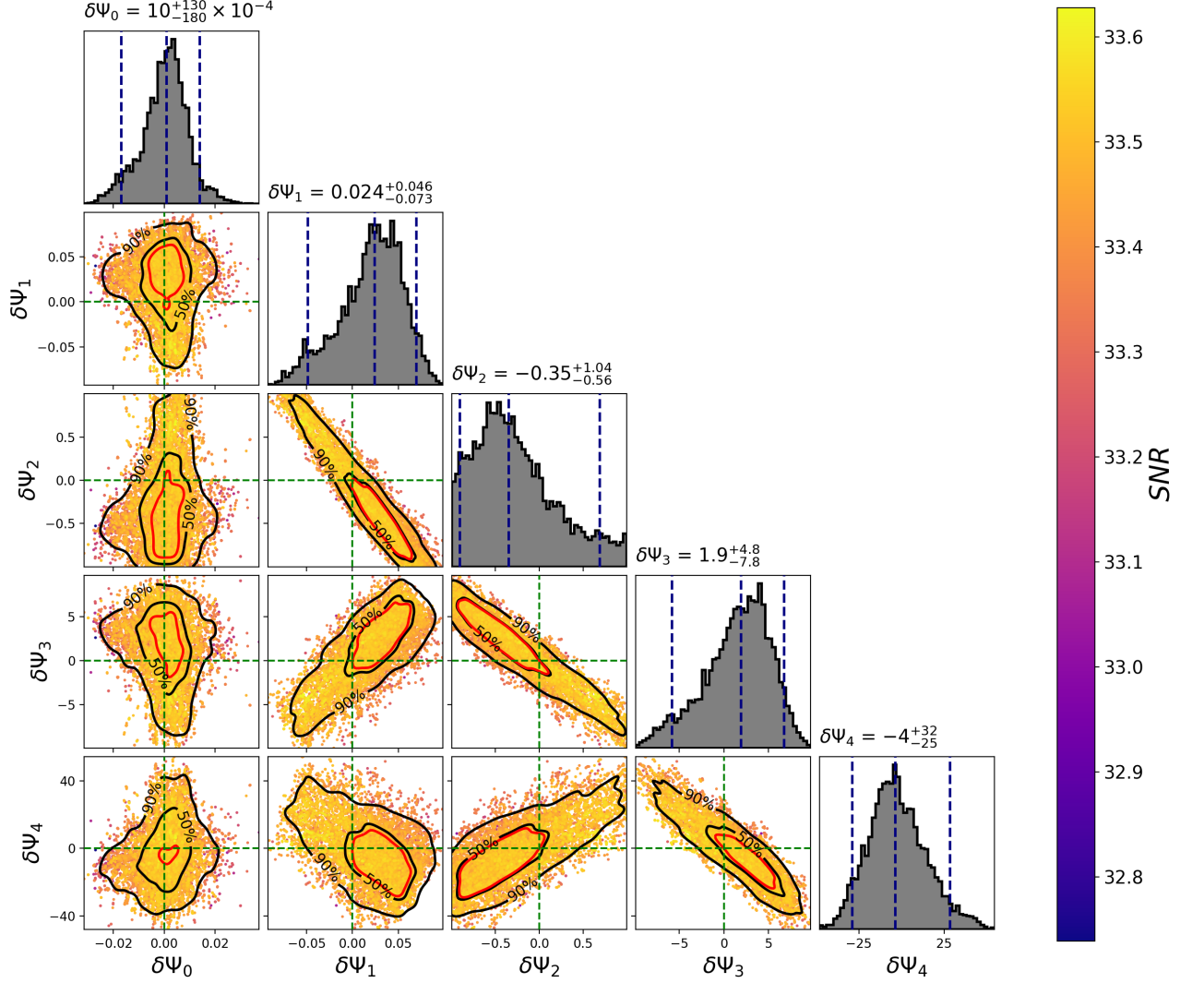


FIG. 3. Posterior density distributions of the non-GR parameters from Fig. 1. The central plots are 2D marginal posteriors, where the black contours show the 50% and 90% credible regions. The upper and the right plots are the 1D marginal posteriors, where the median and 90% credible intervals are indicated by the dashed lines. Red contours are defined by vanishing non-GR parameters indicated by intersection of the green dashed lines. They define confidence regions of the 2D joint distributions.

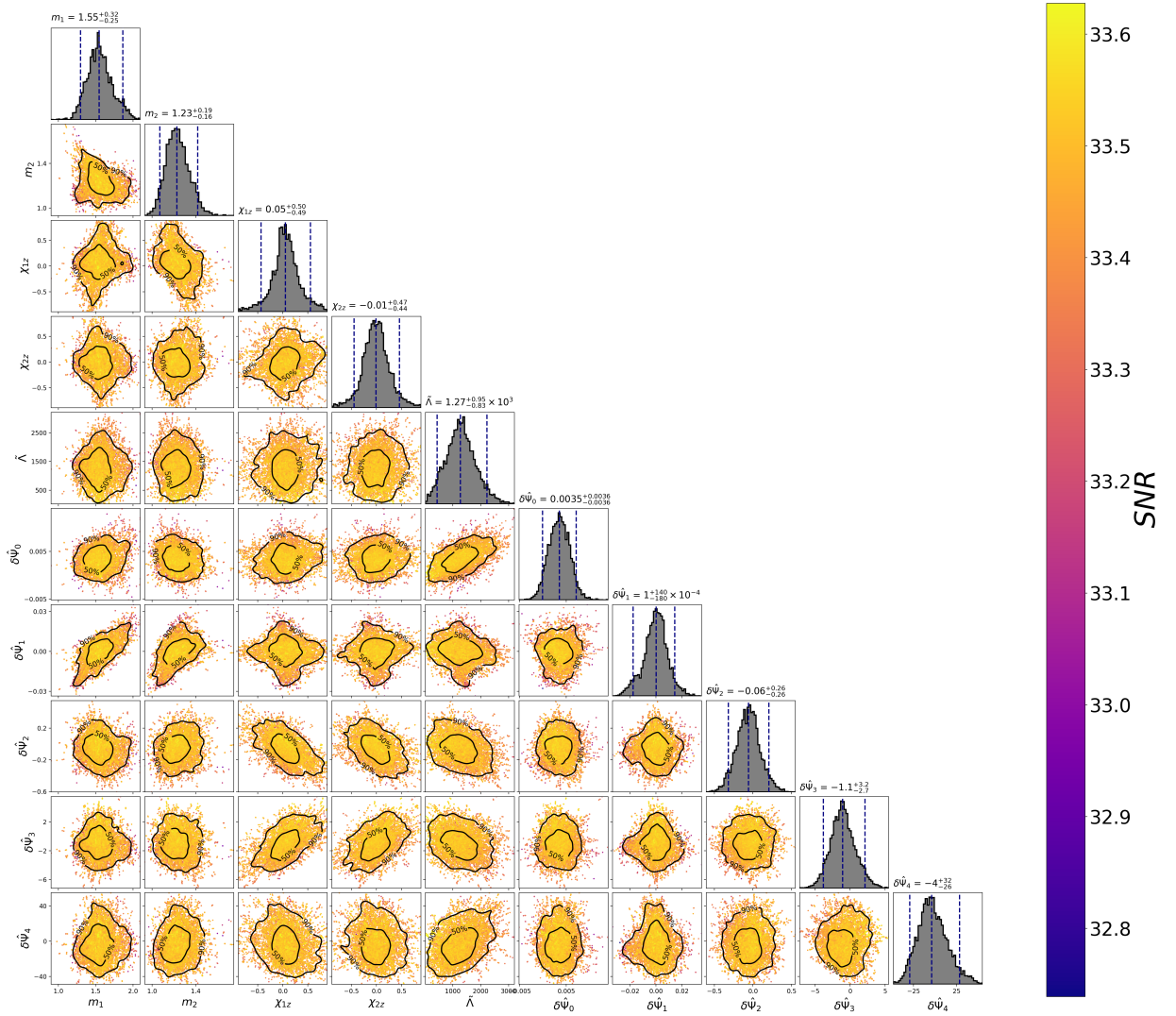


FIG. 4. Posterior density distributions of the binary parameters and the uncorrelated non-GR parameters. The central plots are 2D marginal posteriors, where the black contours show the 50% and 90% credible regions. The upper and the right plots are the 1D marginal posteriors, where the median and 90% credible intervals are indicated by the dashed lines.