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LVC notation conventions

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1 Event naming

For gravitational-wave transients, the naming convention is determined by the time of observation: GWYYMMDD_HHMMSS[.secondsFraction], and the secondsFraction is optional (only necessary to avoid collisions). Details of the naming convention are given in LIGO-M2000069. Full event names should be used in all figures and tables; however, since full names are lengthy, abbreviations are allowed within the papers text where no confusion is possible. These abbreviations should be truncated to the level of detailed required for an unambiguous identification, for example, GWYYMMDD, GWYYMMDD_HH or GWYYMMDD_HHMM, but not GWYYMMDD_H or GWYYMMDD_HHM. Additionally, exceptional events (such as those published in individual papers) may be given shorter names at the time of first publication. Historical detections prior to the adoption of the full naming convention, such as GW150914 are assuming to fall in this category. The event name corresponds to the signal, not the source.

2 Numerical values

For quoting the results of parameter estimation, population inference, and similar:

1. The standard form to quote results is as a median plus a 90% symmetric credible interval, for example $10.1^{+2.5}_{-3.1}$, where 10.1 is the median (50-th percentile), $10.1 - 3.1 = 7.0$ is the 5-th percentile, and $10.1 + 2.5 = 12.6$ is the 95-th percentile. The symmetric 90% credible interval encloses the central 90% of the probability, with equal amounts in both tails. In some cases, for comparison with the literature it is necessary to quote another set of estimates (for example in measuring the Hubble constant, it is tradition to quote a 68% interval). If these are given, it should be in addition to the standard form. Results should not be quoted in this way for significantly multimodal distributions.

2. If a range is quoted, this is by default the 90% symmetric credible interval. Using the example above, this would be 7.0–12.6. Ranges can be useful in text where the exact value is less important than the general region of parameter space to the argument, or if the distribution is sufficiently complicated that giving a median point estimate is misleading.

3. If an upper limit or lower limit is quoted, this should be the 90% upper limit (50-th percentile) or the 90% lower limit (10-th percentile). These are not the same as the limits of 90% symmetric credible interval (as they are asymmetric, excluding 10% of the probability either above or below). Limits should be used when a distribution is skewed to one side, as is often the case for the mass ratio (peaking at $q = 1$ or dimensionless spin magnitudes (peaking at $\chi = 0$).

4. If a single point estimate is used, for example in a title, the median should be used as a default, and it should be preceded by a `\sim`, for example ~ 10. It is preferred to use median and uncertainties over point estimates in general text discussions.

5. A consistent number of decimal places should be used when quoting ranges or uncertainties: 10^{+2}_{-3} is correct, 10.1^{+2}_{-3} and $10^{+2.5}_{-3.1}$ are not. The number of significant figures used should be picked such that rounding error is smaller than statistical error, for example $0.4^{+1.0}_{-0.1}$ is better than 0^{+1}_{-0}. Excessive significant figures should also be avoided, for example $4132.5^{+125.9}_{-144.2}$ implies that we know the result to the nearest 0.1, or $\sim 0.1\%$ of our statistical uncertainty, which will typically not be the case. Two significant figures on the uncertainty is typically sufficient. Rounding should be done as the final operation, therefore it is perfectly possible that we quote a median and uncertainty as $10.1^{+2.5}_{-3.1}$ and a range as 6.9–12.5.

When using logarithms, the base must always be unambiguously identified. For base-10 use $\log_{10}$ and for natural logarithms, use $\ln$. Base-10 is preferred as a default for numerical results.

By default, Bayes factors should be quoted as logarithms in base-10.

3 Symbols

Table 1: Suggested default symbols for compact binary coalescence parameters. Changes from defaults may be needed in the case that there is a clash between symbols. Journal guidelines may require changes to formatting of vectors and subscripts.

Name	**Symbol**	**LaTeX**	**Notes**
Primary mass	m_1	`m_1`	Intrinsic source-frame mass $m_1 \geq m_2$. The primary object is defined as the object with the larger mass.
Secondary mass	m_2	`m_2`	Intrinsic source-frame mass $m_2 \leq m_1$. The secondary object is defined as the object with the smaller mass.
Chirp mass	$\mathcal{M}$	`\mathcal{M}`	Intrinsic source-frame chirp mass.
Total mass	M	`M`	Intrinsic source-frame total mass $M = m_1 + m_2$.
Final mass	M_f	`M_\mathrm{f}`	Intrinsic source-frame remnant mass
Mass ratio	q	`q`	$q = m_2/m_1 \leq 1$
Symmetric mass ratio	η	`\eta`	Less commonly used than q, $\eta = q/(1+q)^2$.
Energy radiated	E_rad	`E_\mathrm{rad}`	$E_\mathrm{rad} = (M - M_\mathrm{f})c^2$.
Peak luminosity	ℓ_peak	`\ell_\mathrm{peak}`	Peak gravitational-wave luminosity. Typically 0.1% of the Planck luminosity for binary black hole coalescences.
Redshifted primary mass	m_1^det	`m_1^\mathrm{det}`	Detector-frame mass $m_1^\mathrm{det} = (1+z)m_1$. Superscript may be suppressed if there is no risk of confusion. *It is recommended to use* $(1+z)m_1$ *rather than introduce a new symbol.*
Redshifted secondary mass	m_2^det	`m_2^\mathrm{det}`	Detector-frame mass $m_2^\mathrm{det} = (1+z)m_2$. Superscript may be suppressed if there is no risk of confusion. *It is recommended to use* $(1+z)m_2$ *rather than introduce a new symbol.*
Redshifted chirp mass	$\mathcal{M}^\mathrm{det}$	`\mathcal{M}^\mathrm{det}`	Detector-frame chirp mass $\mathcal{M}^\mathrm{det} = (1+z)\mathcal{M}$. Superscript may be suppressed if there is no risk of confusion. *It is recommended to use* $(1+z)\mathcal{M}$ *rather than introduce a new symbol.*
Redshifted total mass	M^det	`M^\mathrm{det}`	Detector-frame total mass $M^\mathrm{det} = (1+z)M$. Superscript may be suppressed if there is no risk of confusion. *It is recommended to use* $(1+z)M$ *rather than introduce a new symbol.*
Redshifted final mass	$M_\mathrm{f}^\mathrm{det}$	`M_\mathrm{f}^\mathrm{det}`	Detector-frame remnant mass $M_\mathrm{f}^\mathrm{det} = (1+z)M_\mathrm{f}$. Superscript may be suppressed if there is no risk of confusion. *It is recommended to use* $(1+z)M_\mathrm{f}$ *rather than introduce a new symbol.*
Primary spin angular momentum	$\boldsymbol{S}_1$	`\boldsymbol{S}_1`	Dimensionful spin vector of primary
Secondary spin angular momentum	$\boldsymbol{S}_2$	`\boldsymbol{S}_2`	Dimensionful spin vector of secondary
Primary dimensionless spin magnitude	χ_1	`\chi_1`	$\chi_1 = \lvert c\boldsymbol{S}_1/(Gm_1^2)\rvert$
Secondary dimensionless spin magnitude	χ_2	`\chi_2`	$\chi_2 = \lvert c\boldsymbol{S}_2/(Gm_2^2)\rvert$
Newtonian orbital angular momentum	$\boldsymbol{L}$	`\boldsymbol{L}`	Defines z-direction for spin coordinates
Total angular momentum	$\boldsymbol{J}$	`\boldsymbol{J}`	$\boldsymbol{J} = \boldsymbol{L} + \boldsymbol{S}_1 + \boldsymbol{S}_2$
Remnant dimensionless spin magnitude	χ_f	`\chi_\mathrm{f}`	

Table 1: Suggested default symbols for compact binary coalescence parameters. Changes from defaults may be needed in the case that there is a clash between symbols. Journal guidelines may require changes to formatting of vectors and subscripts.

Name	Symbol	LaTeX	Notes
Primary tilt angle	θ_1 (or θ_{LS_1})	`\theta_1` (or `\theta_{LS_1}`)	Angle between $\boldsymbol{S}_1$ and $\boldsymbol{L}$
Secondary tilt angle	θ_2 (or θ_{LS_2})	`\theta_2` (or `\theta_{LS_2}`)	Angle between $\boldsymbol{S}_2$ and $\boldsymbol{L}$
Effective inspiral spin parameter	χ_{eff}	`\chi_\mathrm{eff}`	$\chi_{\mathrm{eff}} = (m_1\chi_1 \cos\theta_1 + m_2\chi_2 \cos\theta_2)/M$
Effective precession spin parameter	χ_{p}	`\chi_\mathrm{p}`	
Orbital inclination angle	ι	`\iota`	Angle between $\boldsymbol{L}$ and the line of sight
Source inclination angle	θ_{JN}	`\theta_{JN}`	Angle between $\boldsymbol{J}$ and the line of sight
Viewing angle	Θ	`\Theta`	$\Theta = \min\{\theta_{\mathrm{JN}}, \pi - \theta_{\mathrm{JN}}\}$.
Luminosity distance	D_{L}	`D_\mathrm{L}`	
Comoving distance	D_{C}	`D_\mathrm{C}`	
Redshift	z	`z`	The current default cosmology is the 2015 Planck TT+lowP+lensing+ext cosmology with Hubble constant $H_0 = 67.90\ \mathrm{km\,s^{-1}\,Mpc^{-1}}$ and matter density $\Omega_{\mathrm{m}} = 0.3065$.
Primary dimensionless tidal deformability	Λ_1	`\Lambda_1`	$\Lambda_1 = 0$ for black holes.
Secondary dimensionless tidal deformability	Λ_2	`\Lambda_2`	$\Lambda_2 = 0$ for black holes.
Effective tidal deformability	$\tilde{\Lambda}$	`\tilde{\Lambda}`	Mass-weighted combination of Λ_1 and Λ_2.
Primary radius	R_1	`R_1`	Radius of primary object. Used in defining neutron star compactness.
Secondary radius	R_2	`R_2`	Radius of secondary object. Used in defining neutron star compactness
Sky area	$\Delta\Omega$	`\Delta\Omega`	Localization area, typically taken as the 90% credible area. If results at different credible levels are quoted, these should be indicated with a subscript, e.g., $\Delta\Omega_{50}$ and $\Delta\Omega_{90}$.
Volume localization	ΔV	`\Delta V`	Localization volume, typically taken as the 90% credible volume. If results at different credible levels are quoted, these should be indicated with a subscript, e.g., ΔV_{50} and ΔV_{90}.
Merger rate density	$\mathcal{R}$	`\mathcal{R}`	Subscripts can be used if considering different populations, e.g., $\mathcal{R}_{\mathrm{BNS}}$, $\mathcal{R}_{\mathrm{NSBH}}$ and $\mathcal{R}_{\mathrm{BBH}}$.

4 Table contents

Suggested contents for summary tables of source properties:

1. Masses

   - m_1, m_2, $\mathcal{M}$ and M should be given.
   - q should be given, but may need to be reported as a lower limit if not bounded away from 1.
   - M_{f} should be given for binary black holes. For other sources, this may need to be revised to an upper limit excluding mass lost via ejecta.

- Redshifted masses need not be given, but the redshifted chirp mass or either the total mass or final mass may be given if they are well measured, or if they help identify the frequency range of interest (for example, for a ringdown analysis).

2. Spins
   - $\chi_{\rm eff}$ should be given.
   - $\chi_{\rm f}$ should be given for binary black holes.
   - $\chi_{\rm p}$, χ_1 or χ_2 may be quoted if they are well measured. A limit could be quoted if the distribution is not bounded away from 0 (or exceptionally 1).

3. Tidal parameters
   - For neutron star systems, $\tilde{\Lambda}$ should be quoted if well measured.
   - Λ_1 or Λ_2 may be quoted if measured.

4. Extrinsic parameters
   - $D_{\rm L}$ and z should be given.
   - For systems where localization is important (for example, if there is a counterpart or observing with an upgraded network), $\Delta\Omega$ should be given.
   - θ_{JN} or Θ may be given if well measured and important for understanding the source (for example, if there is a counterpart or for discussion of higher-order multipole moments).

Other parameters may be added as relevant to the source, or for comparison.