Documentation Of GWFrames

Contact: consider opening a GitHub issue or find me at m-melching@web.de.

For the most recent version of all the files, see https://github.com/MaxMelching/gw_frames. This file was compiled on October 12, 2025 and the corresponding git commit hash is e560985 (or, in case you need the full one, e560985d8f0b208bfbfdc8011d01365f6adf3857).

1 Overview

This repository contains three packages, each providing one command:

- cbc_frames_tikz (command \drawframes): plots a selection of source frame, signal frame, and celestial frame that are used to describe gravitational waves emitted by compact binary coalescences.
- cbc_binary_tikz (command \drawbinary): plots intrinsic parameters of a system of two compact binary objects. Adapted from code originally written by Jannik Mielke.
- earth_tikz (command \drawearth): plots one side of the Earth. Mainly intended for usage through \drawframes. Most of the credit for this code goes to Izaak Neutelings, who provided it on https://tikz.net/astronomy_seasons/.

Several examples of how to use this package are shown in the examples folder.

2 List Of Keyword Arguments

Note that certain values cannot be passed to pgfkeys, which is particularly relevant for declaration of labels. If you encounter an issue of this kind, look up the command that this key is stored in (typically something like \<parameter>Label), and manually set the command. This can be done using \def\<parameter>Label{<input>}. A practical example would be \def\OmegaLabel{$\Omega = \pi/2 + \mathrm{longAscNodes}$}.

2.1 cbc_frames_tikz

This is a list of all keyword arguments (note that all angles are expected to be given in degrees):

- mass1: mass of the first compact object, determining its size. Ten solar masses correspond to a size of $0.35\,\mathrm{cm}$.

  Default = 20
- mass2: mass of the second compact object, determining its size. Ten solar masses correspond to a size of $0.35\,\mathrm{cm}$.

  Default = 20
- longascnodes: determines the angle between x-axis of the signal frame and the ascending node ☊, this angle being $\Omega = 90 + \mathrm{longAscNodes}$.

  Default = 0
- inclination: inclination between orbital plane and sky plane. This rotation is about the ascending node ☊.

  Default = 0

- phiref: reference angle ϕ_{ref} that determines the rotation between ascending node and x-axis of the signal frame (about the inclined z-axis of the signal frame).

  Default = 0

- ra
- dec
- polarization: polarization angle, i.e. rotation of the x-axis in the sky plane (about the line of sight).
- eccentricity
- axislen: length of the axes in each coordinate system.

  Default = 3 cm

- binaryscalefactor: distance of binary companions, in multiples of the axis length axislen.

  Default = 1

- binarydistance: distance of binary center of mass from Earth, in multiples of the axis length axislen.

  Default = 3

- showcelestialframe: determines whether to show the celestial frame. Has precedence over the other commands for styling of celestialframe, such as celestialframeaxes.

  Default = true

- celestialframeaxes
- celestialframehelperlines
- celestialframeangles
- showlineofsight
- showsignalframe: determines whether to show the signal frame. Has precedence over the other commands for styling of signalframe, such as signalframeaxes.

  Default = true

- signalframeaxes
- signalframehelperlines
- signalframeangles
- showsourceframe
- sourceframeaxes
- sourceframehelperlines
- earthradius
- earthtilt:
- showifo: whether to draw an interferometer on Earth or not.
- ifoarmlength: arm length of the interferometer.

  Default = 2 cm

2.2 cbc_binary_tikz

2.3 earth_tikz