Simulation of Stochastic Gravitational Wave by merging PBHs: LALSuite Package

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- An Introduction to Ligo Scientific Collaboration Algorithm Library Suite
- Simulating a Custom SGWB Using LALSuite

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Outline

- Introduction
- Reading Documentations
- My Results

LSC Soft

> “The LIGO Scientific Collaboration (LSC) is a group of scientists focused on the direct detection of gravitational waves, using them to explore the fundamental physics of gravity, and developing the emerging field of gravitational wave science as a tool of astronomical discovery.”

The software section of LSC is consisted of many open source projects such as:

- LALSuite
- Bilby
- GWCelery
- ...

LALSuite

- The LSC Algorithm Library Suite (LALSuite) is comprised of various gravitational wave data analysis routines written in C

- It consists of 9 libraries, thousands of constants, variables, functions and classes and tens of executable applications

- Wrapers for Phyton and Octave are provided too

LALSuite Code and Documentation

All LSC public projects including LALSuite are accessible from:

https://git.ligo.org/

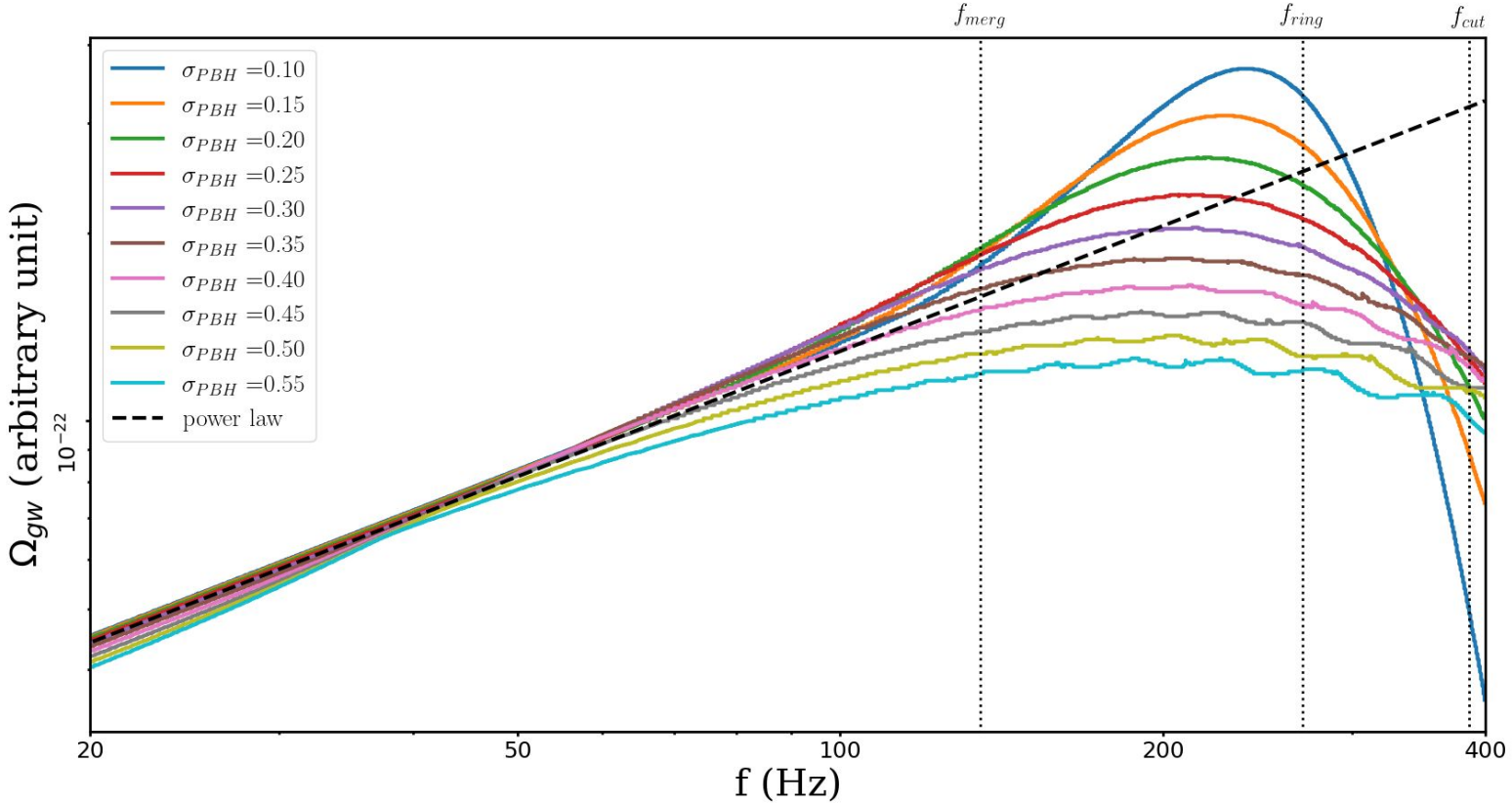
LALSuite has an extensive documentation which is updated daily:

https://lscsoft.docs.ligo.org/lalsuite/

Let’s take a look!

Results

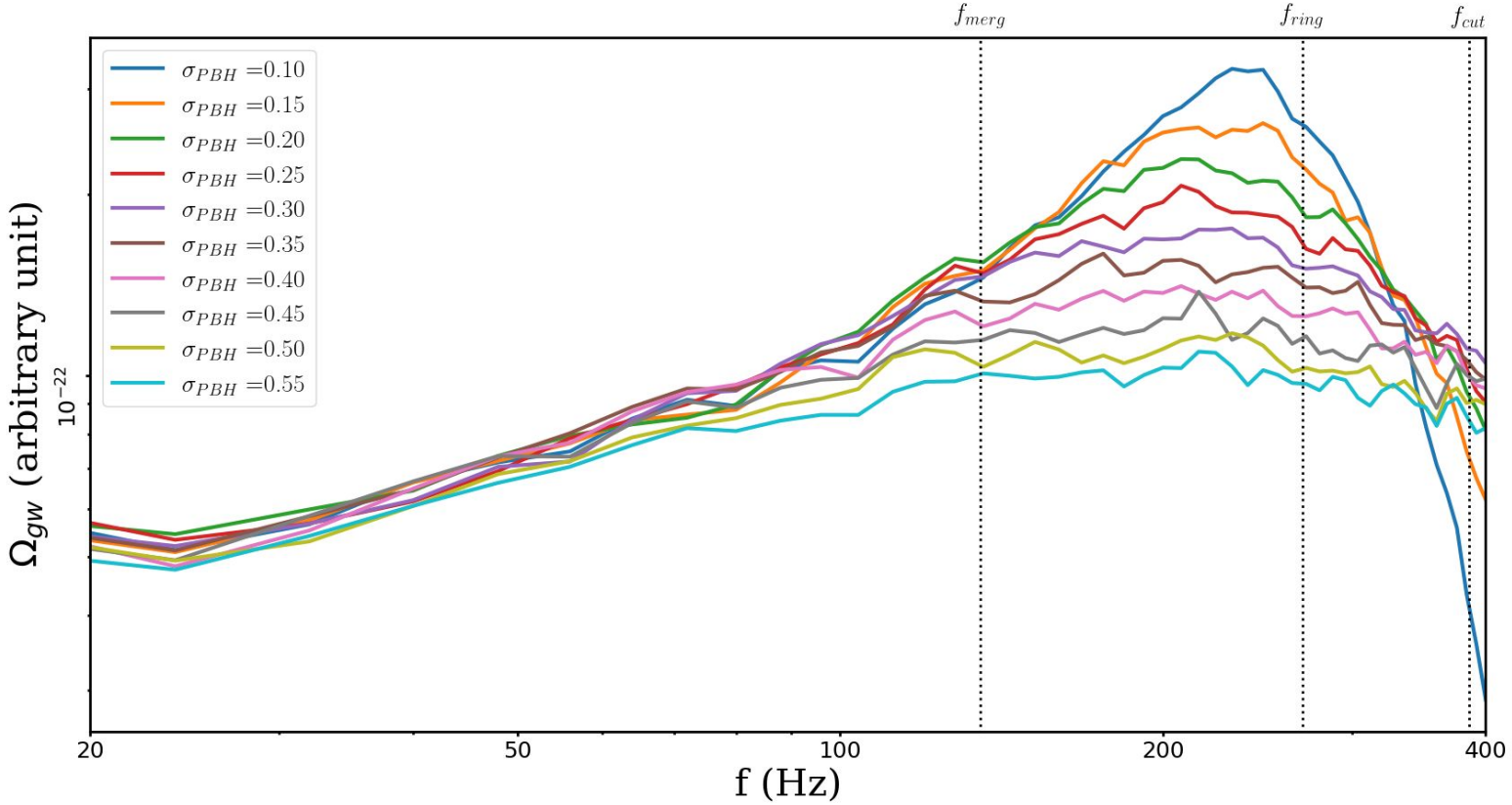
Input


f_{merg}
f_{ring}
f_{cut}
σ_{PBH} =0.10
σ_{PBH} =0.15
σ_{PBH} =0.20
σ_{PBH} =0.25
σ_{PBH} =0.30
σ_{PBH} =0.35
σ_{PBH} =0.40
σ_{PBH} =0.45
σ_{PBH} =0.50
σ_{PBH} =0.55
power law
Ω_{gw} (arbitrary unit)
10^{-22}
20
50
100
200
400
f (Hz)

Output

Parameters:	Sample rate = 4096	t start = 0	Duration = 1000 s
time (s)	**H1:STRAIN (strain)**	**L1:STRAIN (strain)**	**V1:STRAIN (strain)**
0	1.926492821e-30	-1.788444922e-31	5.739186702e-30
0.000244141	1.918054518e-30	-1.579567591e-31	5.748827977e-30
0.000488281	1.911866216e-30	-1.341251071e-31	5.763178836e-30
0.000732422	1.908398694e-30	-1.103798371e-31	5.780976346e-30
0.000976562	1.907868300e-30	-8.963895989e-32	5.800802313e-30
0.001220703	1.910125023e-30	-7.420453039e-32	5.821477487e-30
0.001464844	1.914606396e-30	-6.539958382e-32	5.842313240e-30
0.001708984	1.920400789e-30	-6.340547819e-32	5.863129818e-30

Power Spectral Density



Conclusions (or how to use any open source project)

1. Define what you need
2. Look for methods in the documentation
3. Ask informed questions
4. Write what need
5. If you think it can be useful share it!


Thank you for your attention!
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