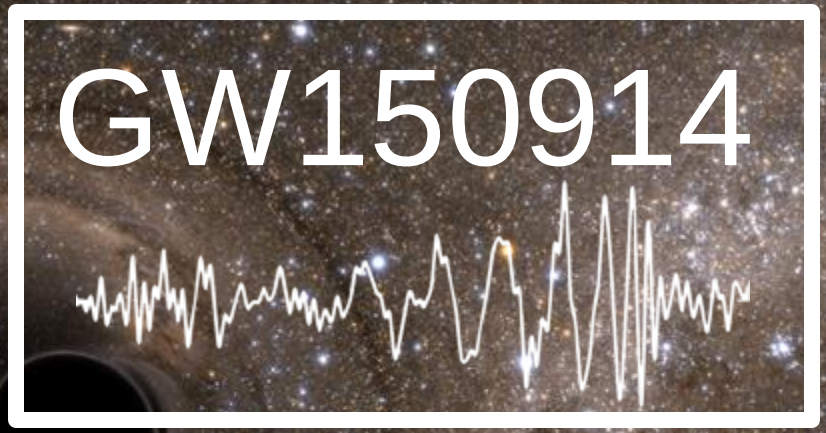
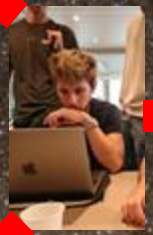
“Finding”

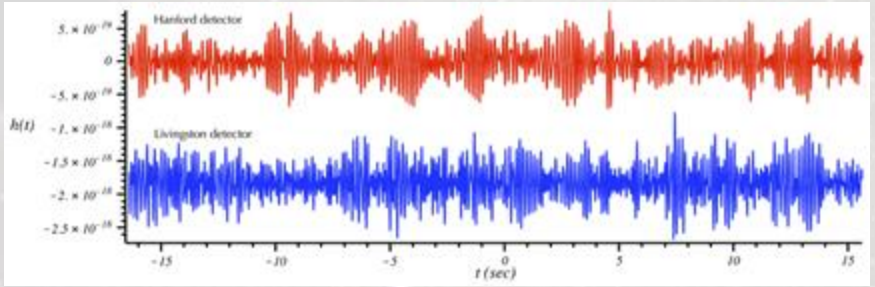


Luca[2] to leading order (+ NNLO)

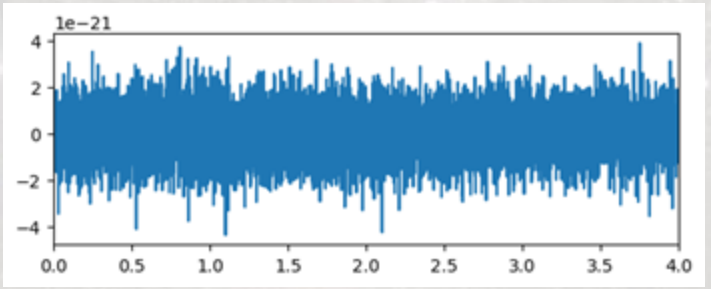



The basic principle

Reality



Pseudo Reality



Luca^2 to leading order : “Finding”

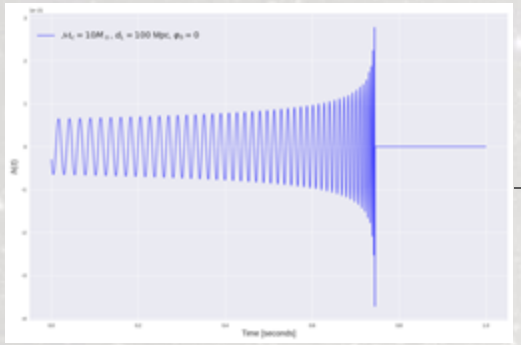
Finding a signal in pseudo data

```
def Chirp_function(Mc, dl, phi0, t):
    Mc = Mc * msun
    dl = dl * 1e6 * pc
    F0 = 40
    _F = Frequency(Mc, F0, t)
    _A = Amplitude(Mc, _F, dl)
    _phi = phi(phi0, Mc, F0, t)
    h_t = _A * np.cos(_phi)
    return h_t
```

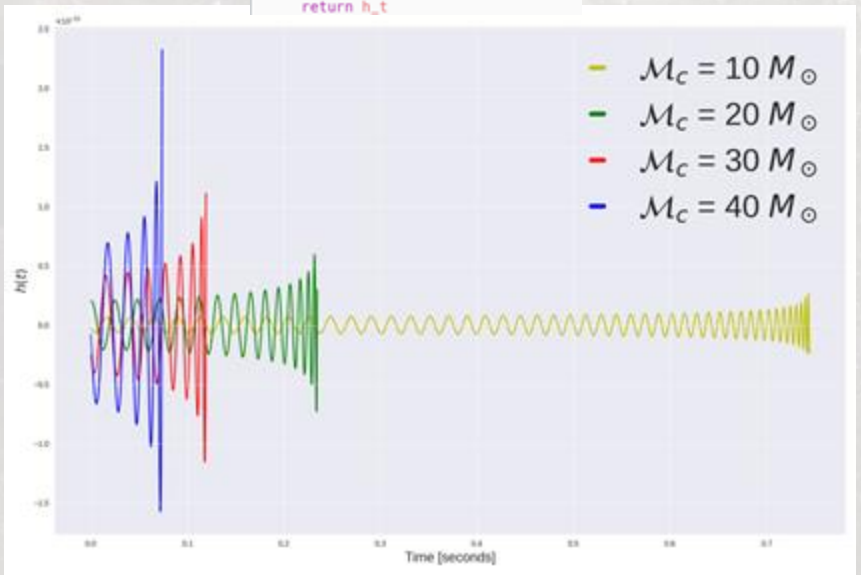
Creating templates

Function of:

Chirp mass, distance, phase, time



Template bank of different masses

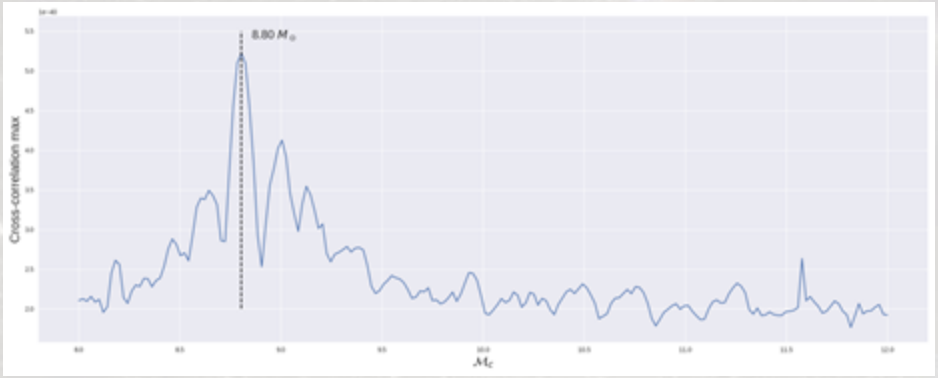


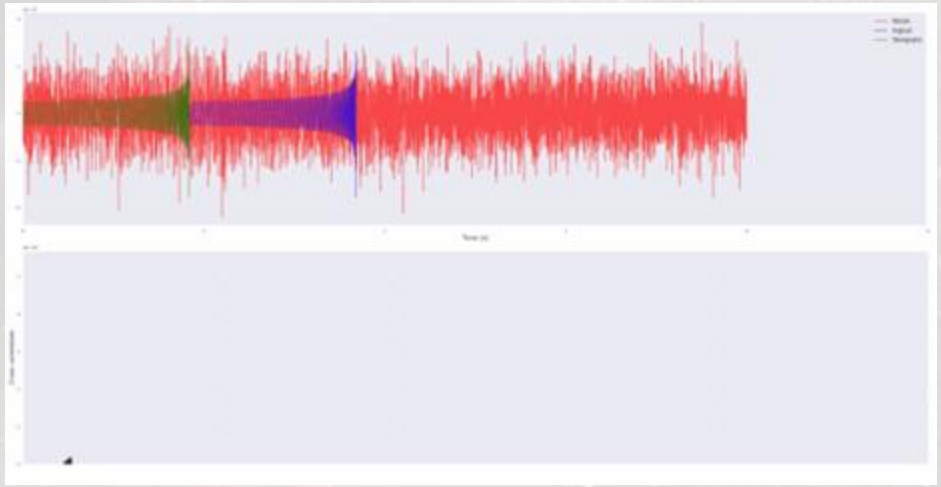
Luca[2] to leading order : “Finding”

Finding a signal in pseudo data

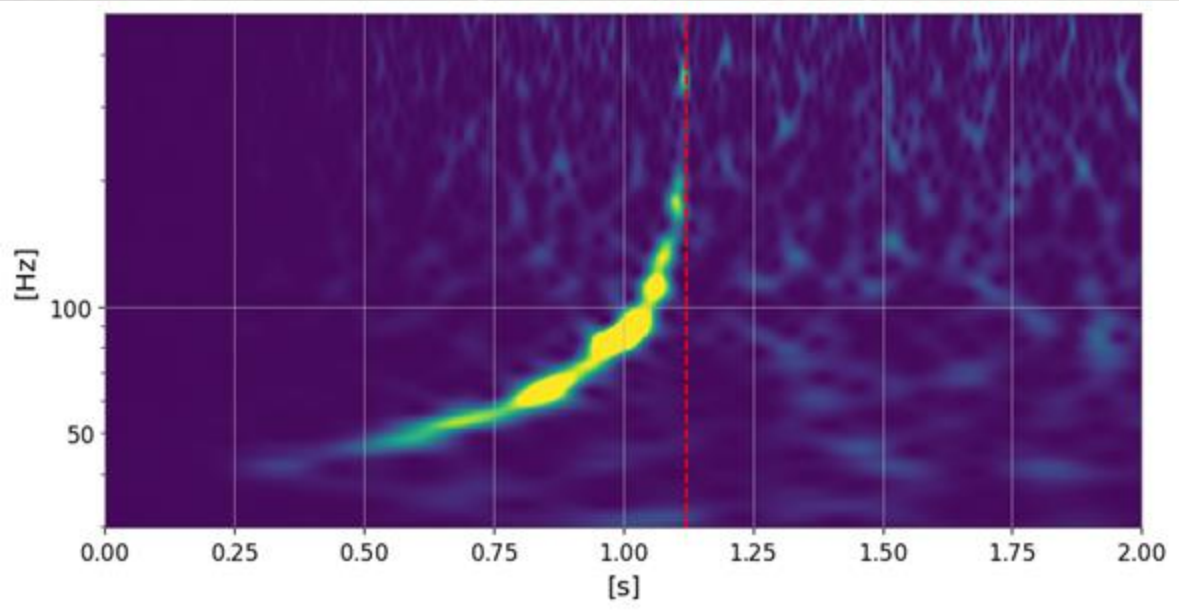
Correlating templates to the data.

$$R(\tau) = \int_{-\infty}^{\infty} x(t+\tau)\,\hat{h}^{\star}(t)\,dt.$$





So did we find it?



Yippie!

Chirp mass found by the match filter : 8.8 msun

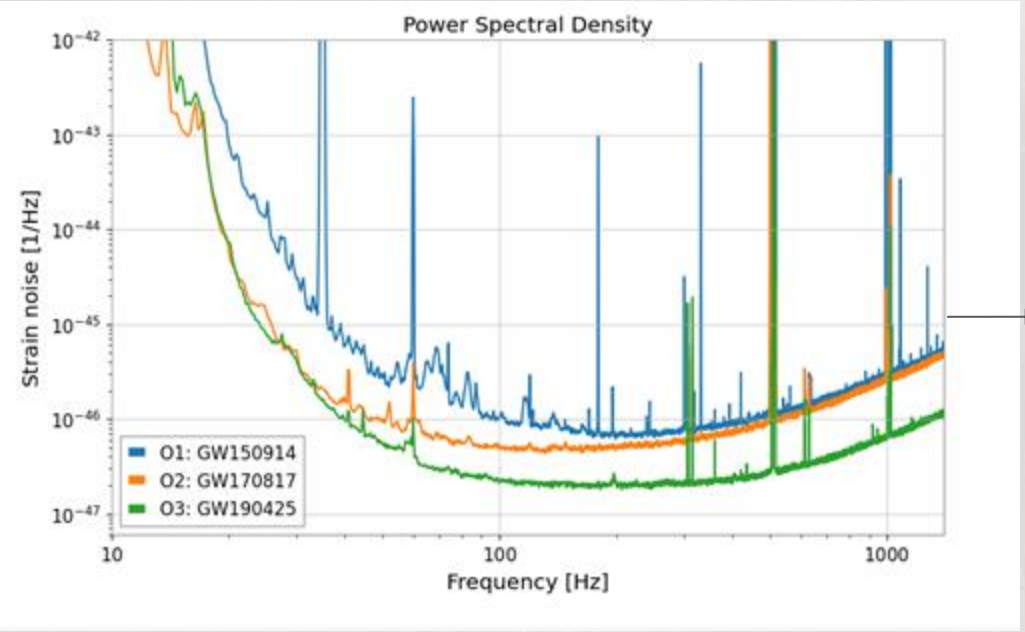
Going to real data

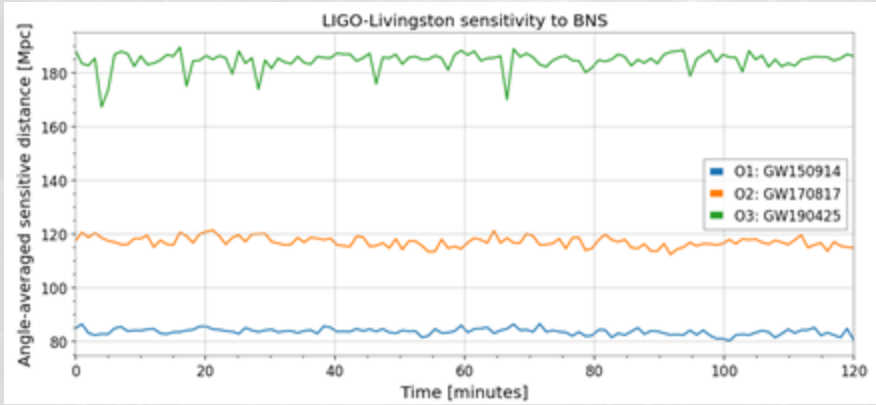
Complications :

- Need to colour the template
- Need a lot of templates
- (Need to clean the data)
- ((Need post newtonian corrections))

We will try to find a Gravitational wave in the data (but we look up the specifics)

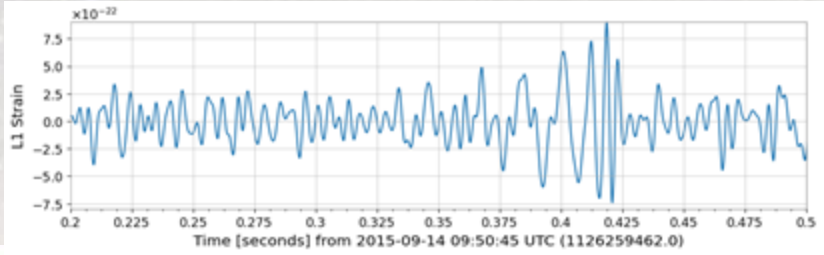
Power spectrums

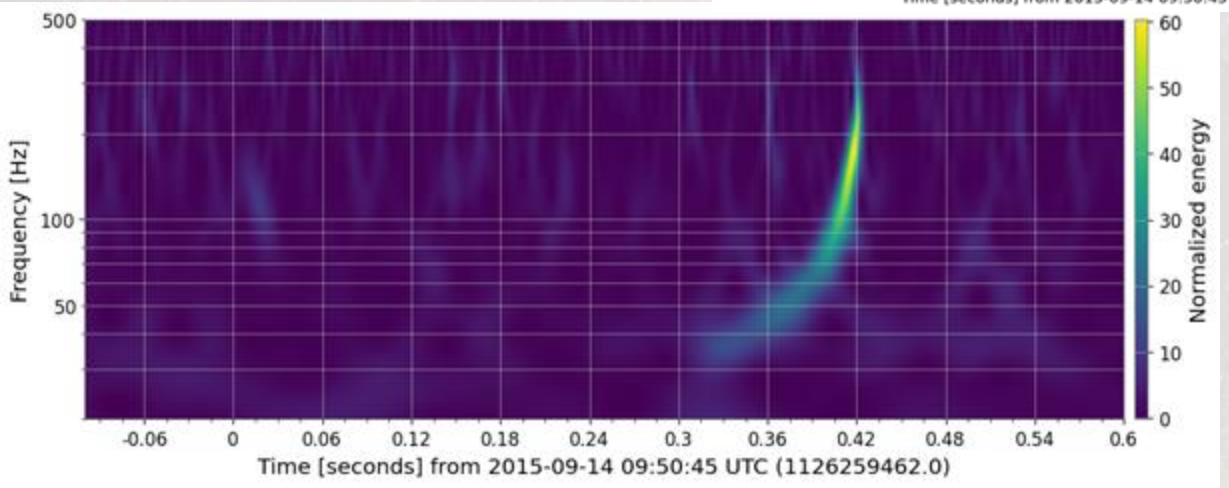




Luca[2] to leading order : “Finding”

GW150914

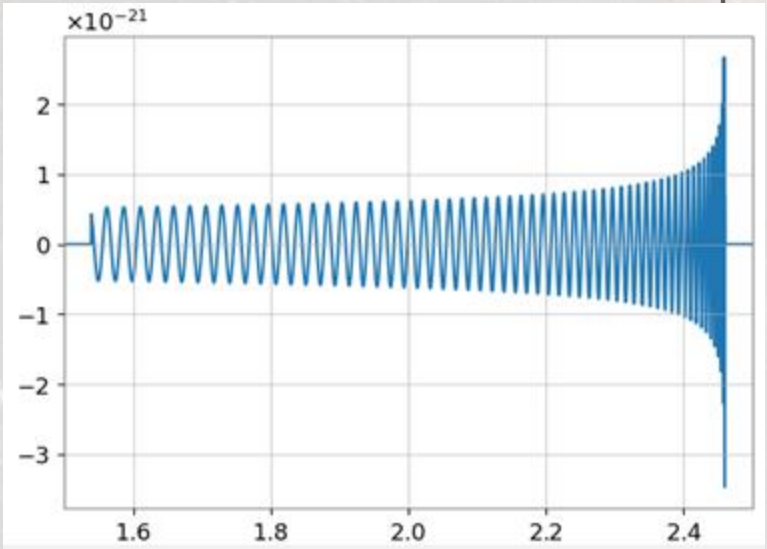


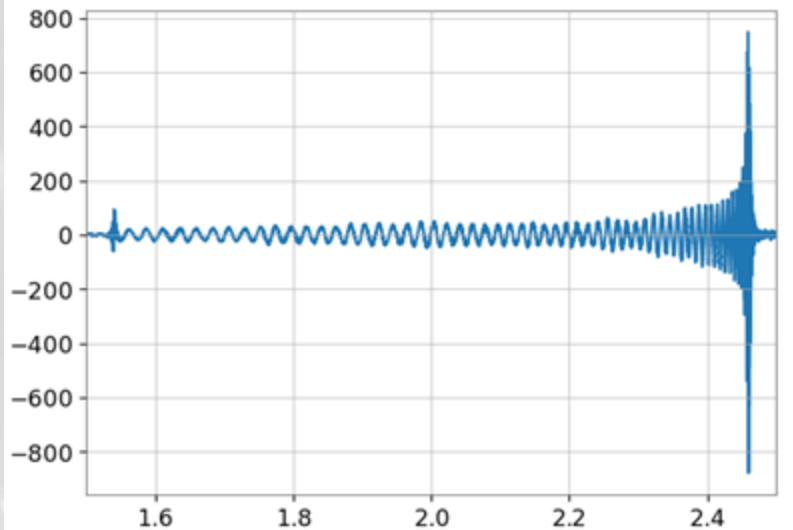


Luca² to leading order : “Finding”

Colouring the template

Use the PSD to colour the template (Ignore the factor ~10^{23} difference on the y-axis)

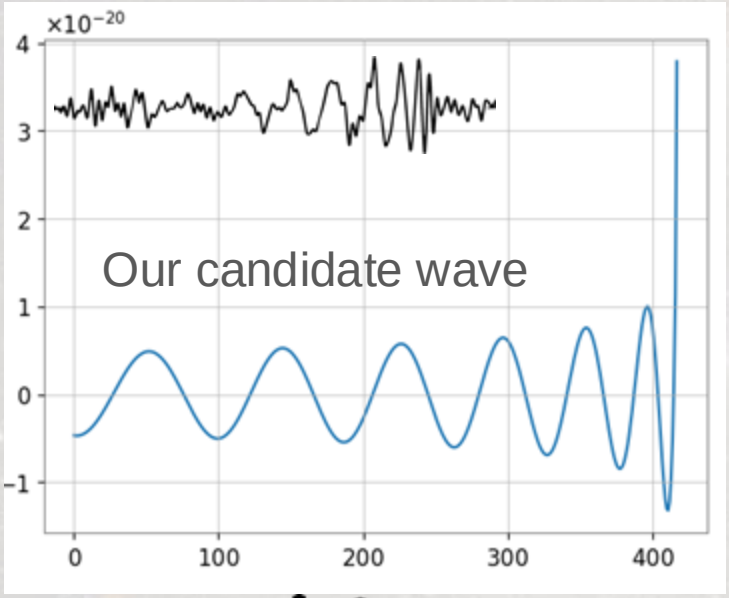


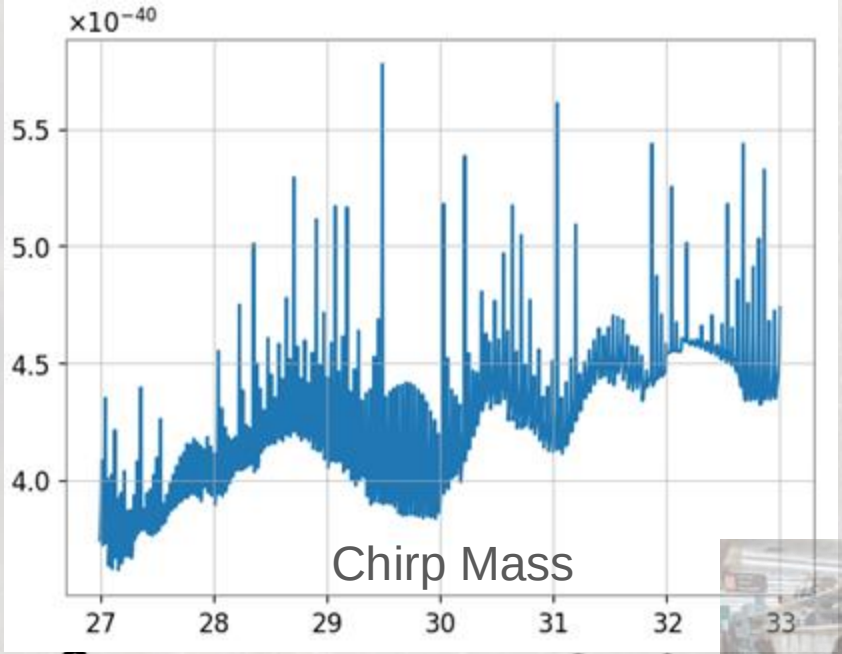


Luca[2] to leading order : “Finding”

So, did we find it?

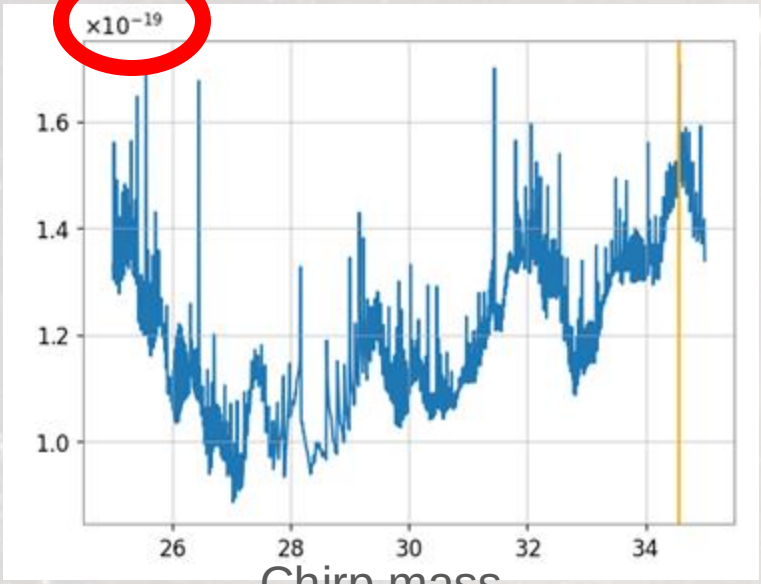
Looking for GW150914 (First effort)





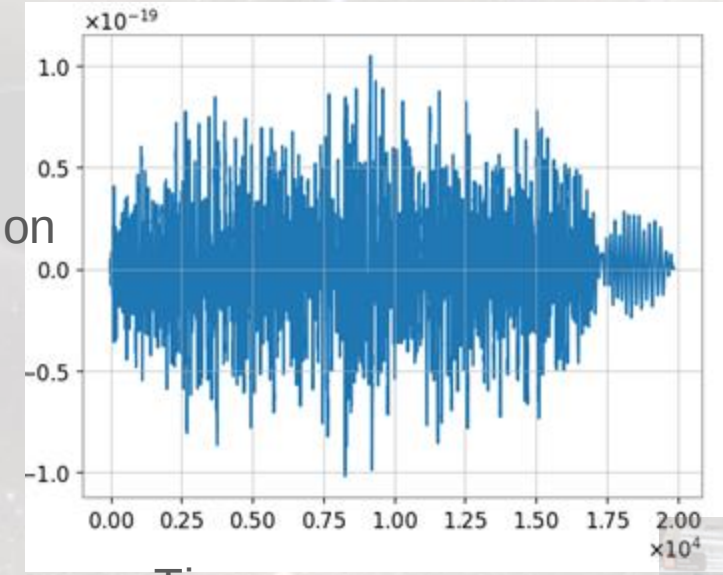
Luca[2] to leading order : “Finding”

Second attempt (Improvement of 21 orders of magnitude!!!)



Chirp mass

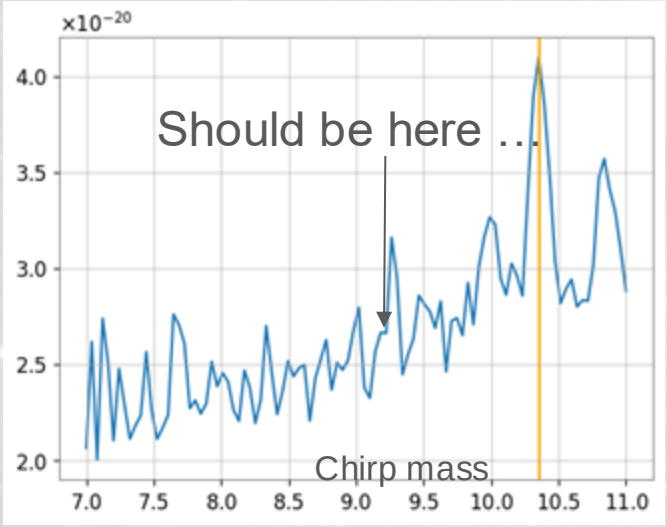
Correlation

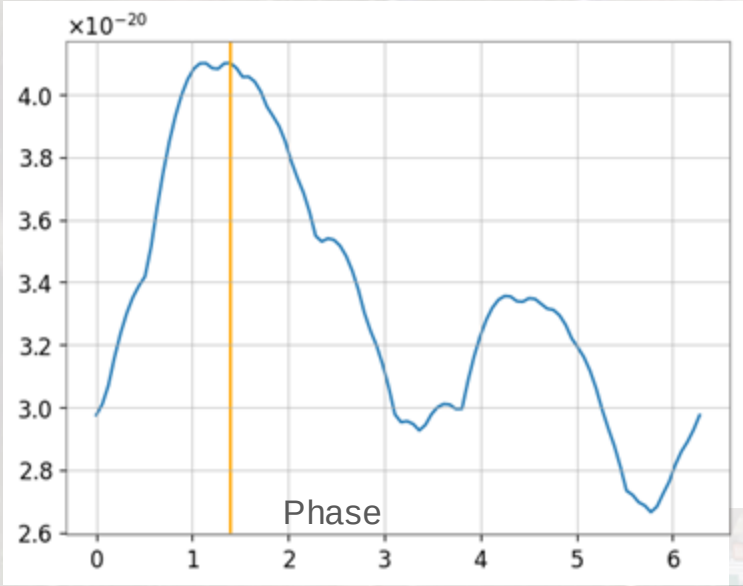


Time

Luca^2 to leading order : “Finding”

Third attempt with new event (GW151226) and expanded grid: looks better! Still wrong





Luca^2 to leading order : “Finding”

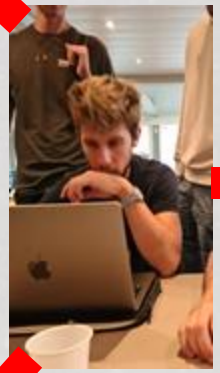
Why didn’t we find it?

Not enough corrections (only NNLO) while Post Newtonian corrections are needed.

Conclusion

We prefer Pseudo reality

Questions?



Luca^2 to leading order : “Finding”