Introduction

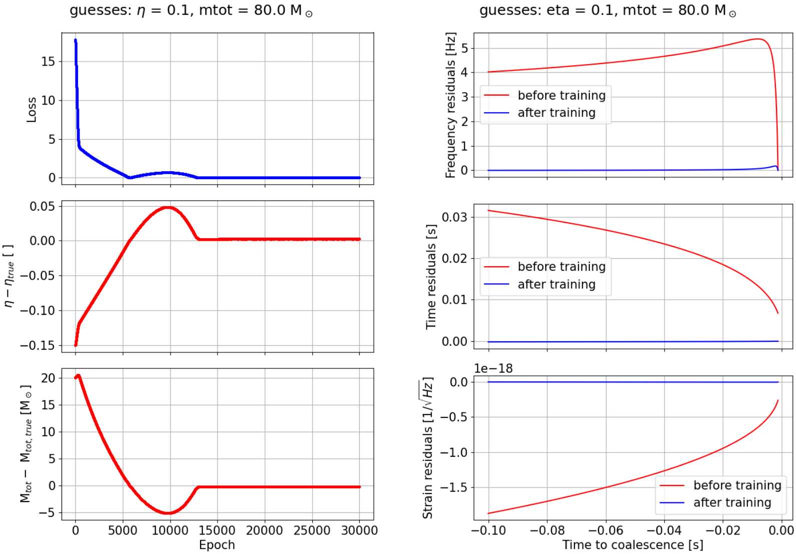
- **PINNGraPE** is a PyTorch algorithm which **does PE for a Gravitational-Wave (GW) signal's source thanks to a Physics-Informed Neural Network (PINN) [?].**

- **We solve (1) thanks to a Recurrent Neural Network** (RNN) with a Runge-Kutta integrator at 4^{th} order implemented inside.

$$\frac{df}{dt} = \mathcal{F}[f, \eta, M_{tot}] \tag{1}$$

$$\begin{aligned} \mathcal{L} =& \frac{\beta_f}{N} \sum_{k=1}^{N} |f_k - f(t_k)| + \\ &+ \frac{\beta_t}{N} \sum_{k=1}^{N} |t_k - t(f(t_k))| + \\ &+ \frac{\beta_h}{N} \sum_{k=1}^{N} |h_k - h(f(t_k))| \end{aligned} \tag{2}$$

Results


guesses: η = 0.1, mtot = 80.0 M☉
guesses: eta = 0.1, mtot = 80.0 M☉
Loss
η − η_true [ ]
M_tot − M_tot, true [M☉]
Epoch
Frequency residuals [Hz]
Time residuals [s]
Strain residuals [1/√Hz]
1e−18
before training
after training
Time to coalescence [s]

Conclusions

- **PINNGraPE is able to infer η and M_{tot} values with 10^{-2} relative error from frequency and strain data, implementing 1.5PN formalism.**
- **Near future steps**:
  - to build a real dataset spanning a physical parameter space;
  - to test robustness against noise and glitches;
  - to extend the number of parameters to infer.
- (Not so) **remote future step**:
  - use of cWB real outputs,
  - apply PINNs approach to TOV equations, in order to constrain NS's equation of state.