Machine Learning Gravitational Waveforms for Binary Neutron Star mergers

Jacopo Tissino

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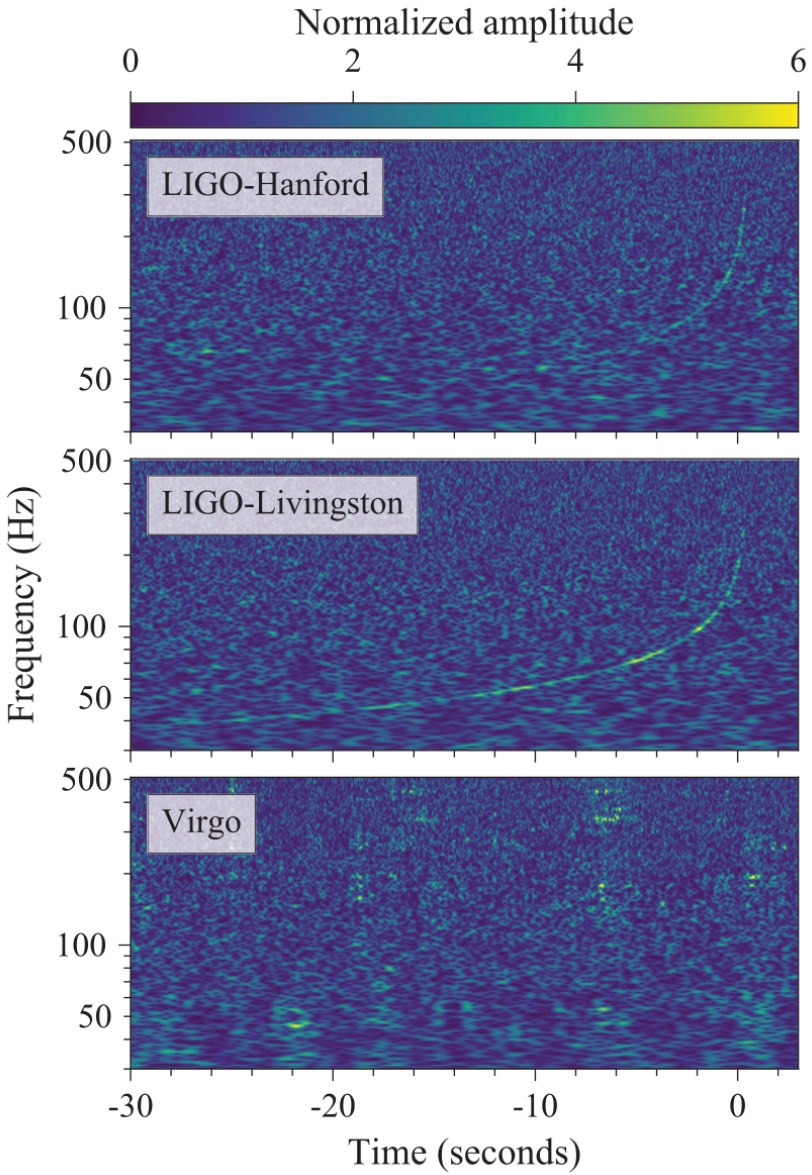
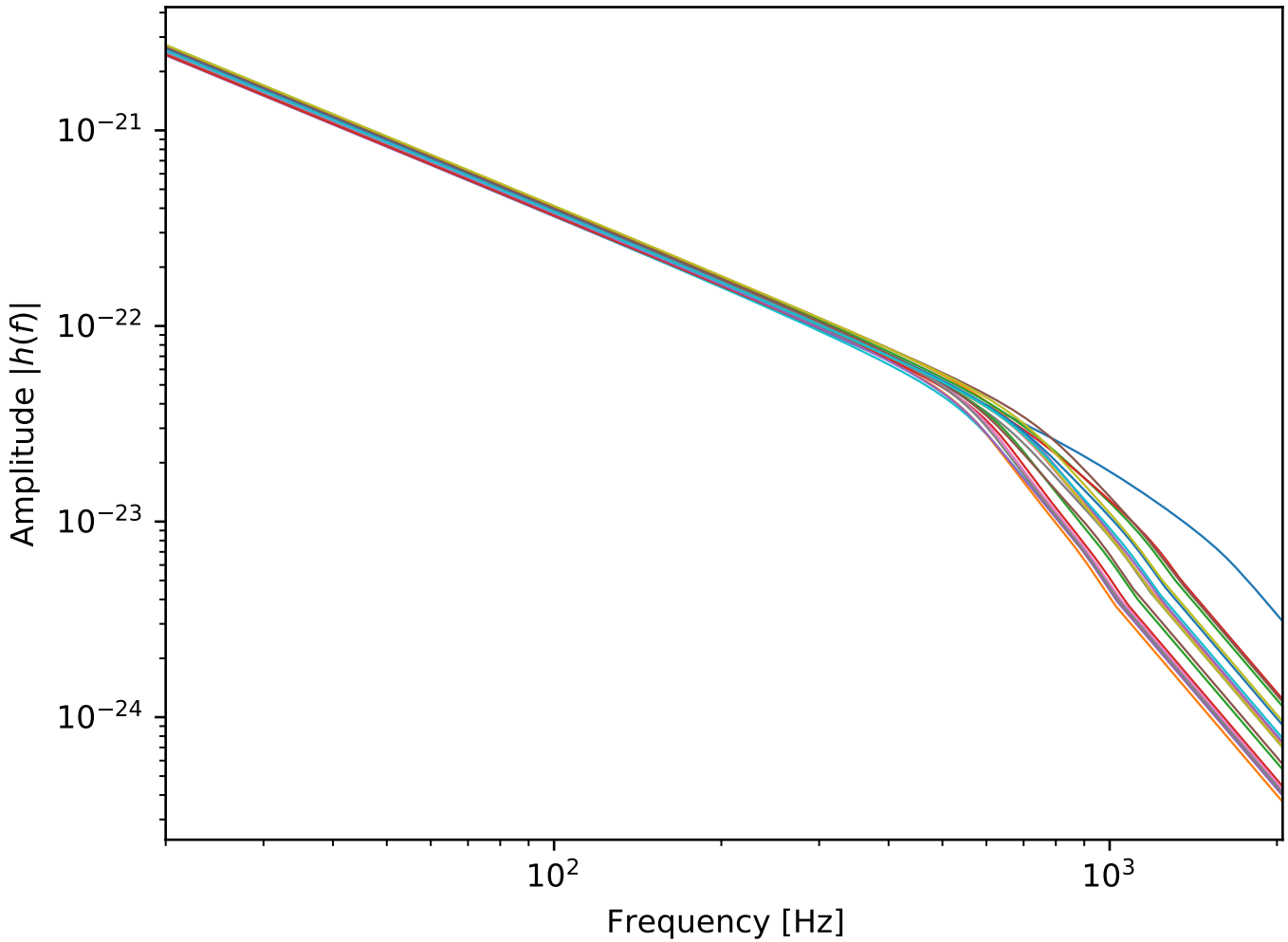
GW170817: the first BNS merger detection

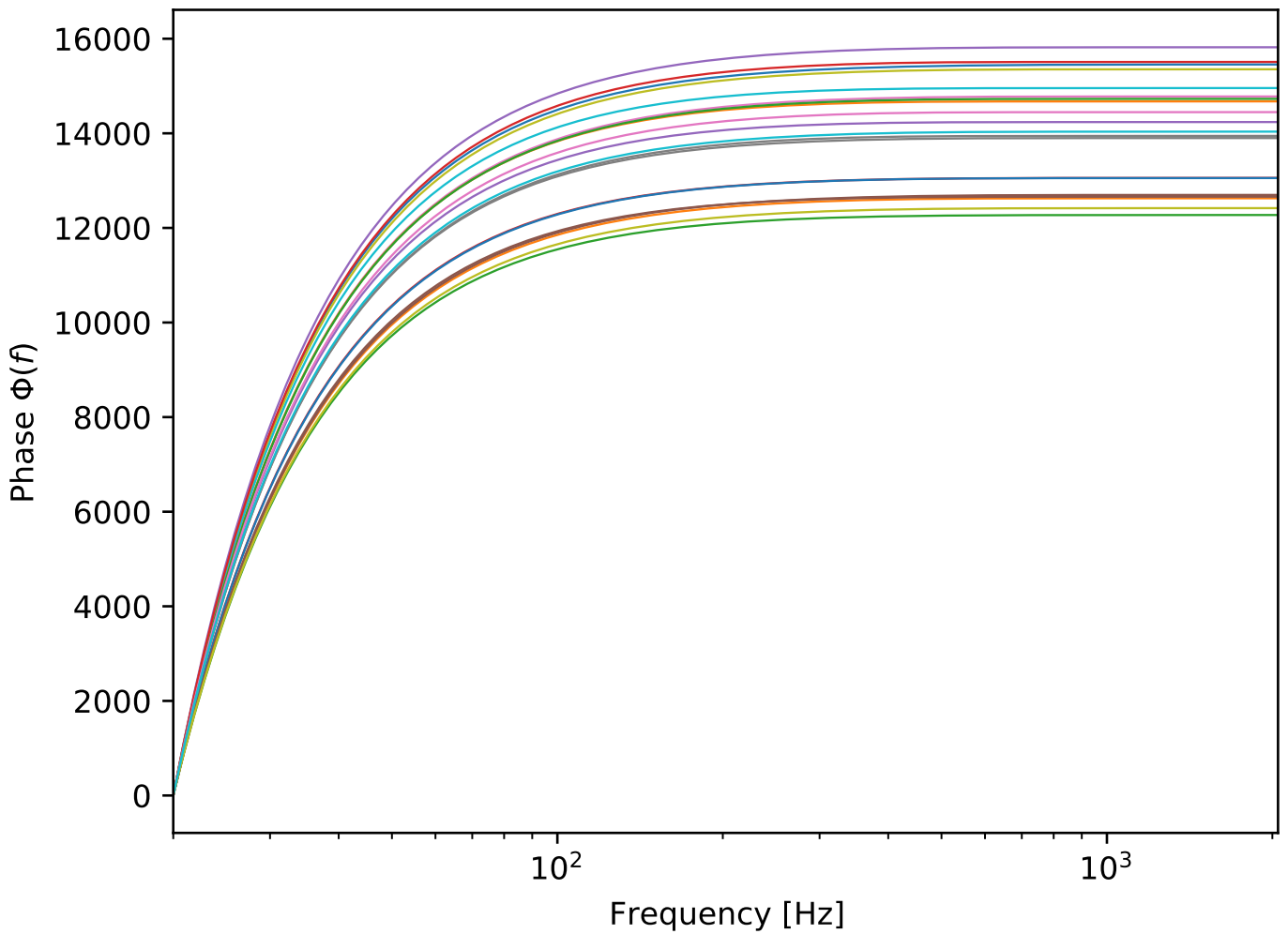


Time-frequency representation of the chirping waveform (Abbott et al. 2017).
BNS waveforms are much longer than BBH ones.

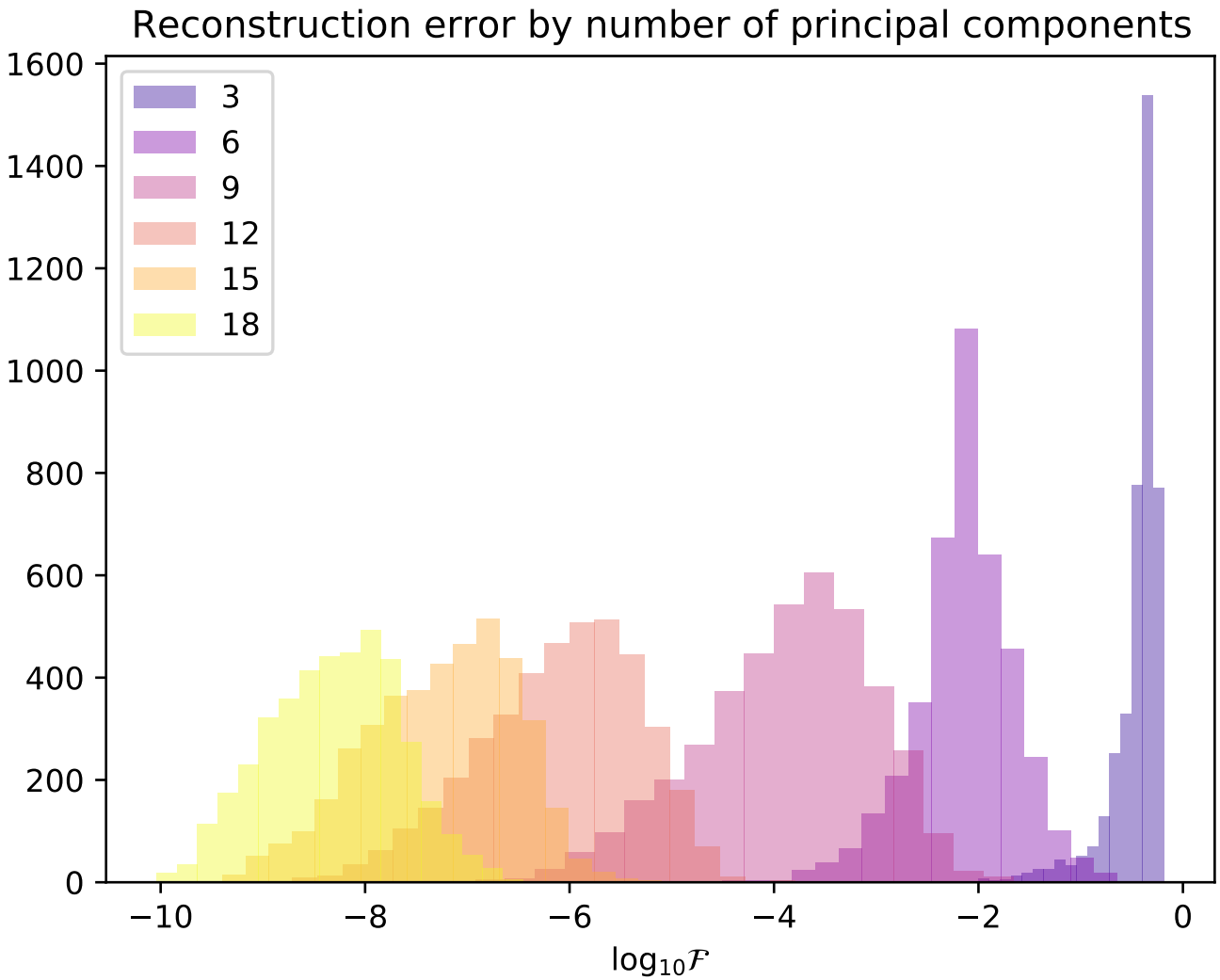
Frequency domain waveforms: amplitude



Frequency domain waveforms: phase



Reconstruction with PCA



Technologies

Python wrapper for `TEOBResumS` for EOB waveform generation;

`python` with standard scientific libraries (`numpy`, `scipy`, `matplotlib`) and `pycbc`;

Neural Network implemented with `scikit-learn`, hyperparameters optimized with `optuna`;

automated testing with `pytest` and `hypothesis`.

Bibliography


Abbott, B. P. et al. (Oct. 16, 2017). "GW170817: Observation of Gravitational Waves from a Binary Neutron Star Inspiral". In: *Physical Review Letters* 119.16, p. 161101.