Basics of PyCBC

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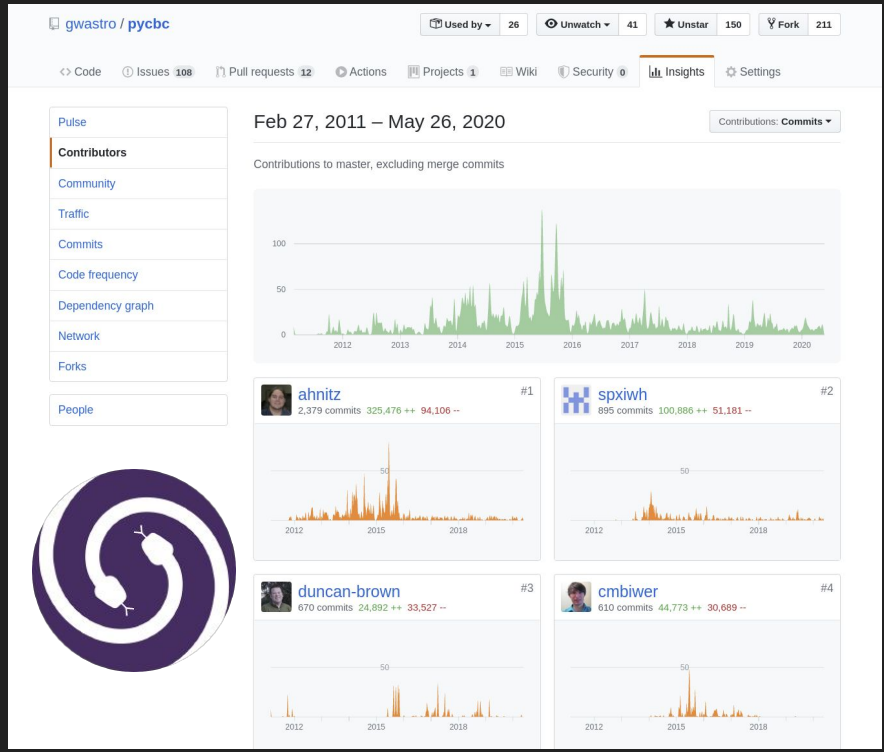
PyCBC: Toolkit for Gravitational-wave Data Analysis

- Began in 2011 as a joint project between the MPI for Gravitational Physics (AEI), Syracuse University, and Cardiff University.
  - ~ 5 initial contributors
- Initial goals:
  - python-based (with hooks into lower-level libaries)
  - modular toolkit
  - flexible computing backends
    - take advantage of GPUs / multicore / etc
  - Build replacement for the aging iHOPE analysis (workhorse search pipeline for analysis of initial LIGO data)
- Open-source (github.com/gwastro/pycbc) and community-developed
- $>$ 80 contributors (as of 2020) from dozens of institutions



PyCBC Impact

- “PyCBC Offline” Flagship archival / deep-offline analysis used by LIGO/Virgo/Kagra
  - Determined significance of GW150914
  - used in all observing runs of the 2G ground-based detectors to detect CBCs
- “PyCBC Live” Low-latency detection of gravitational waves
  - Generated skymap (with Bayestar) used for follow-up of GW170817
  - Producing alerts since O2
- “PyCBC Inference” Bayesian estimation of source parameters and evidence
  - dozens of papers using PyCBC Inference or its data products
- $>$ 200 citations for pycbc codebase

Package Functionality

- core functionality
  - reading detector data
  - data conditioning / deglitching
  - detector response model
  - waveform generation interface
    - interfaces to existing libraries (lalsimulation, TaylorF2e, SEOBNRe)
  - template bank placement
  - matched filtering
  - signal consistency tests
  - candidate ranking statistics
- Documentation
  - https://pycbc.org/pycbc/latest/html/
- Tutorials
  - https://github.com/gwastro/PyCBC-Tutorials