Types of gravitational wave sources and search methods

Sanjeev Dhurandhar

21st August 2019

Different Types of Gravitational Wave Sources

- Compact binary coalescences - Black Holes or Neutron Stars
- Burst Sources - Supernovae etc.
- Stochastic gravitational wave background - Produced by unresolved gravitational wave sources: Supernova core collapses, BBH mergers, r-modes, LMXBs
  - Waveforms not well modeled
- Continuous wave sources - asymmetric rotating neutron stars, pulsars

Types of Signals

- Signals with parametrisable waveforms:
  - Compact binary coalescences
  - Continuous wave sources
  - Stochastic:
    - Stochastic background - Astrophysical, Cosmological
- Unmodelled sources:
  - Bursts and transients

Data analysis techniques

Techniques depend on the type of source

- Compact binary coalescences: Matched filtering
- Bursts: Time-frequency methods
- Continuous wave signals:
  - Fourier transforms after applying Doppler/spin down corrections
  - Cross-correlation methods - different time segments from same detector or different detectors are cross-correlated
- Stochastic background: Optimally weighted cross-correlated data from independent detectors