

Change point detection

- Find an abrupt change (in statistical properties) in time series data
- Applications in imaging (edge detection), human activity analysis, medical condition monitoring, etc
- Can be done online or offline
- Aminikhanghahi & Cook (2017) for an overview - see reading folder

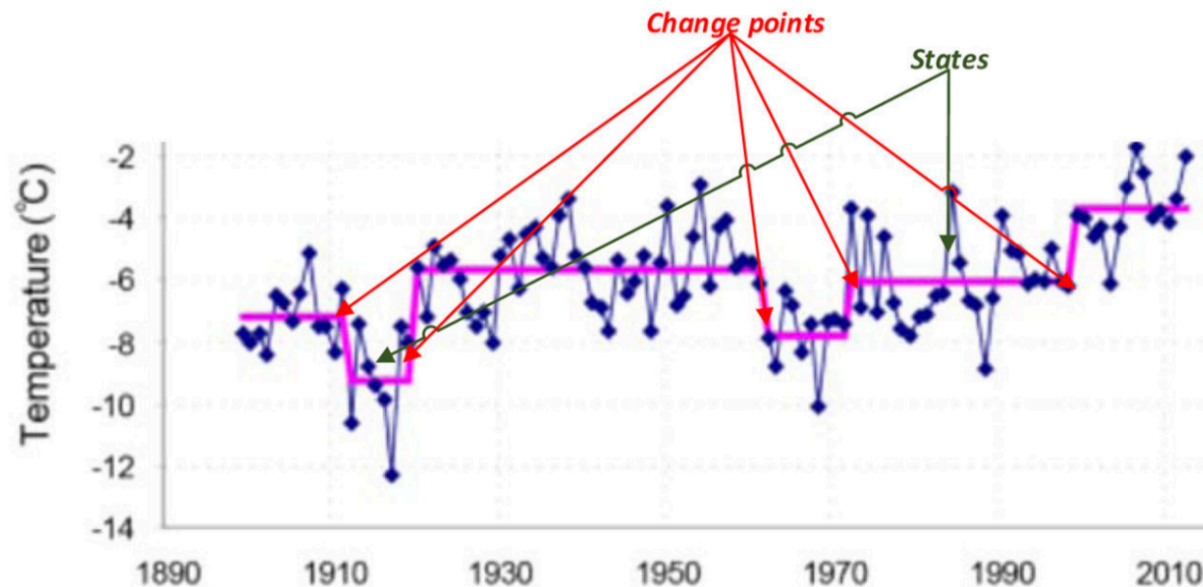


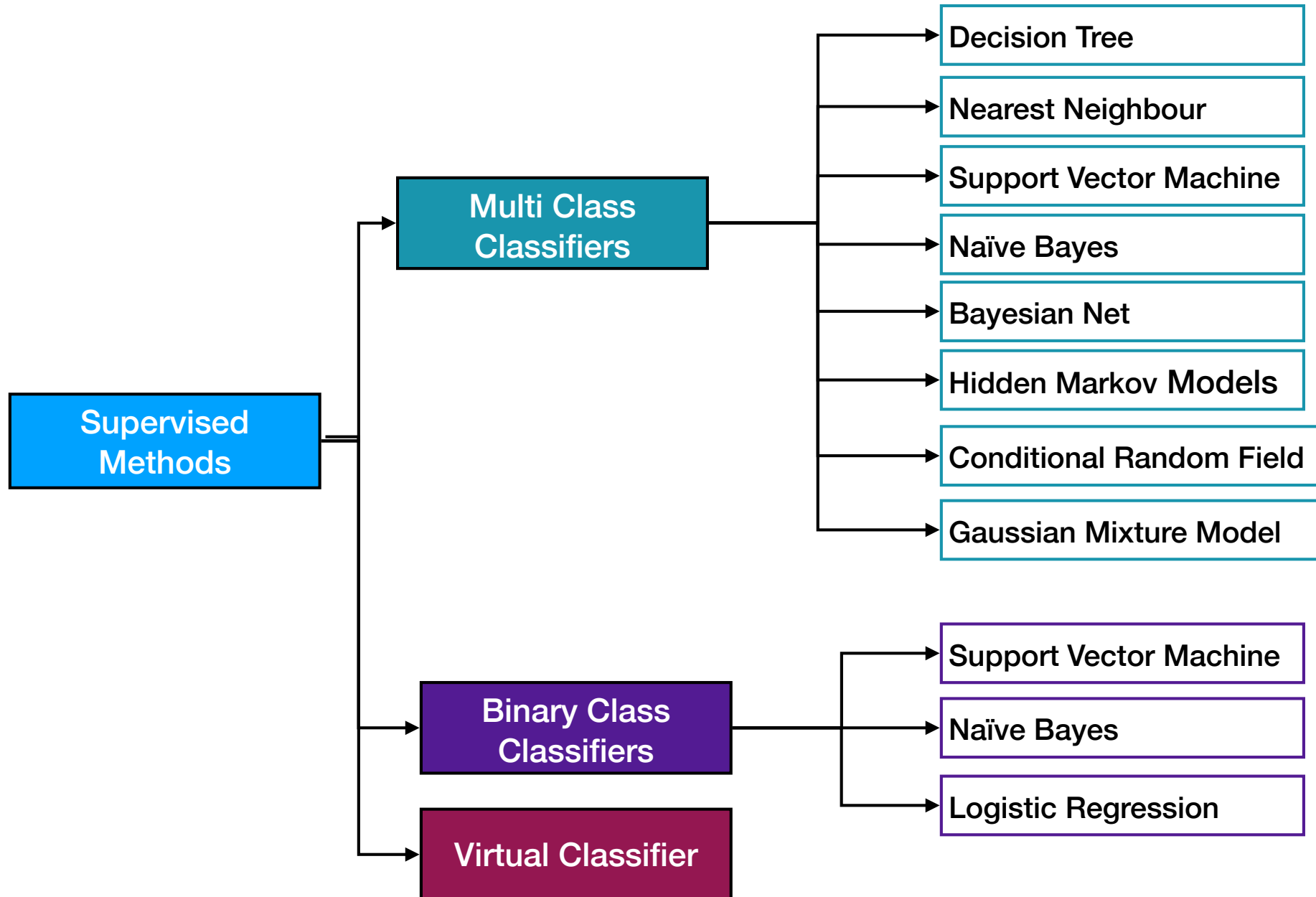
Figure 1.

Sample time series and change points (horizontal lines indicate separate states).

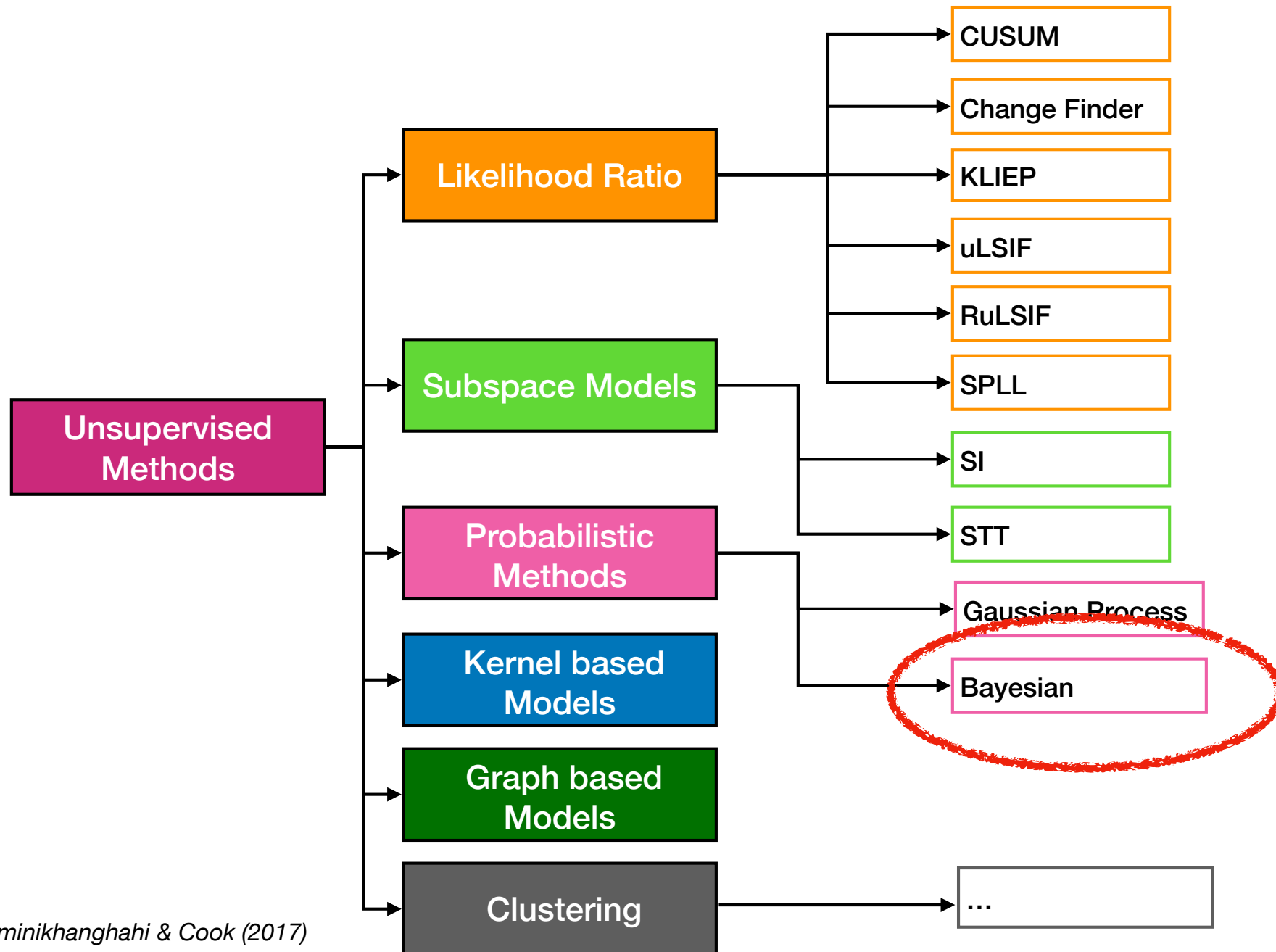
Change point detection

- Algorithms for change point detection
- Aminikhanghahi & Cook (2017) - mostly machine learning
- Supervised & Unsupervised methods

Change point detection



Change point detection



Change point detection

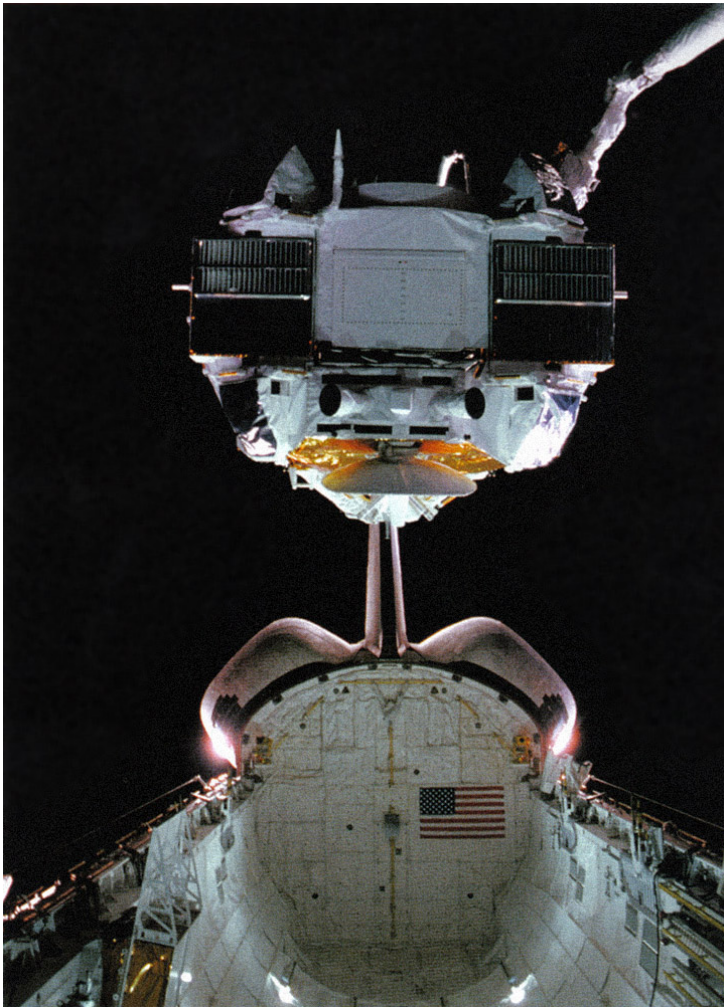
- We will explore a probabilistic method called Bayesian Blocks (Scargle 1998, Scargle et al. 2013)
- Segments the data into time intervals in which there is no statistically significant variations **within** the interval, but discontinuity **at** discrete points separating the intervals.
- Can be implemented in real-time (i.e. on a data stream) or offline

Bayesian blocks algorithm

- Goal is to find optimal segmentation of the data in the observation interval
- Non-parametric - limited assumptions about the data model
- Automatic penalty for model complexity
- Suppress observational errors while preserving valid information
- Can be use in 'trigger' mode, or offline

An aside: CGRO/BATSE

Burst and Transient Source Experiment

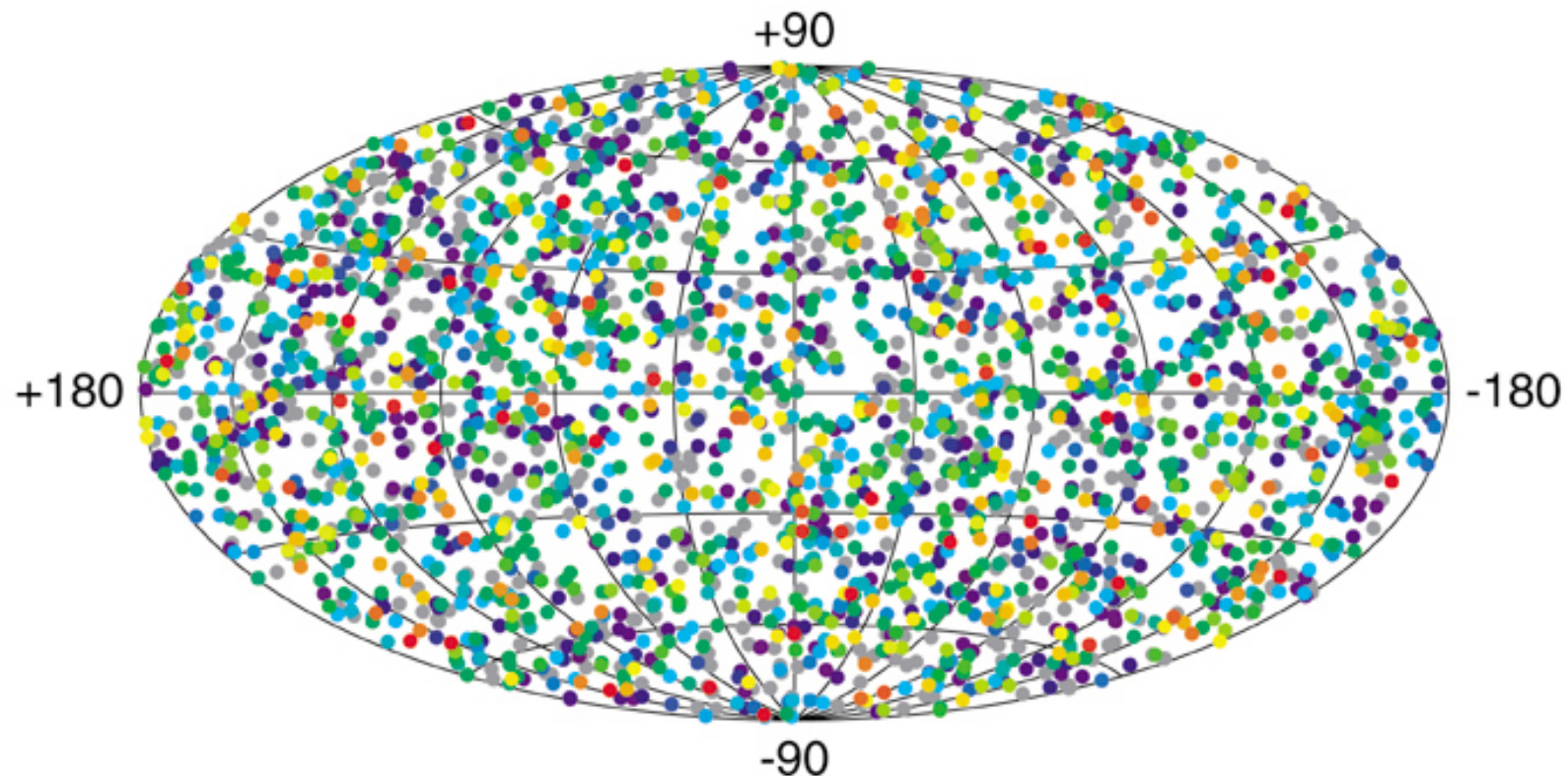


Launched 1991

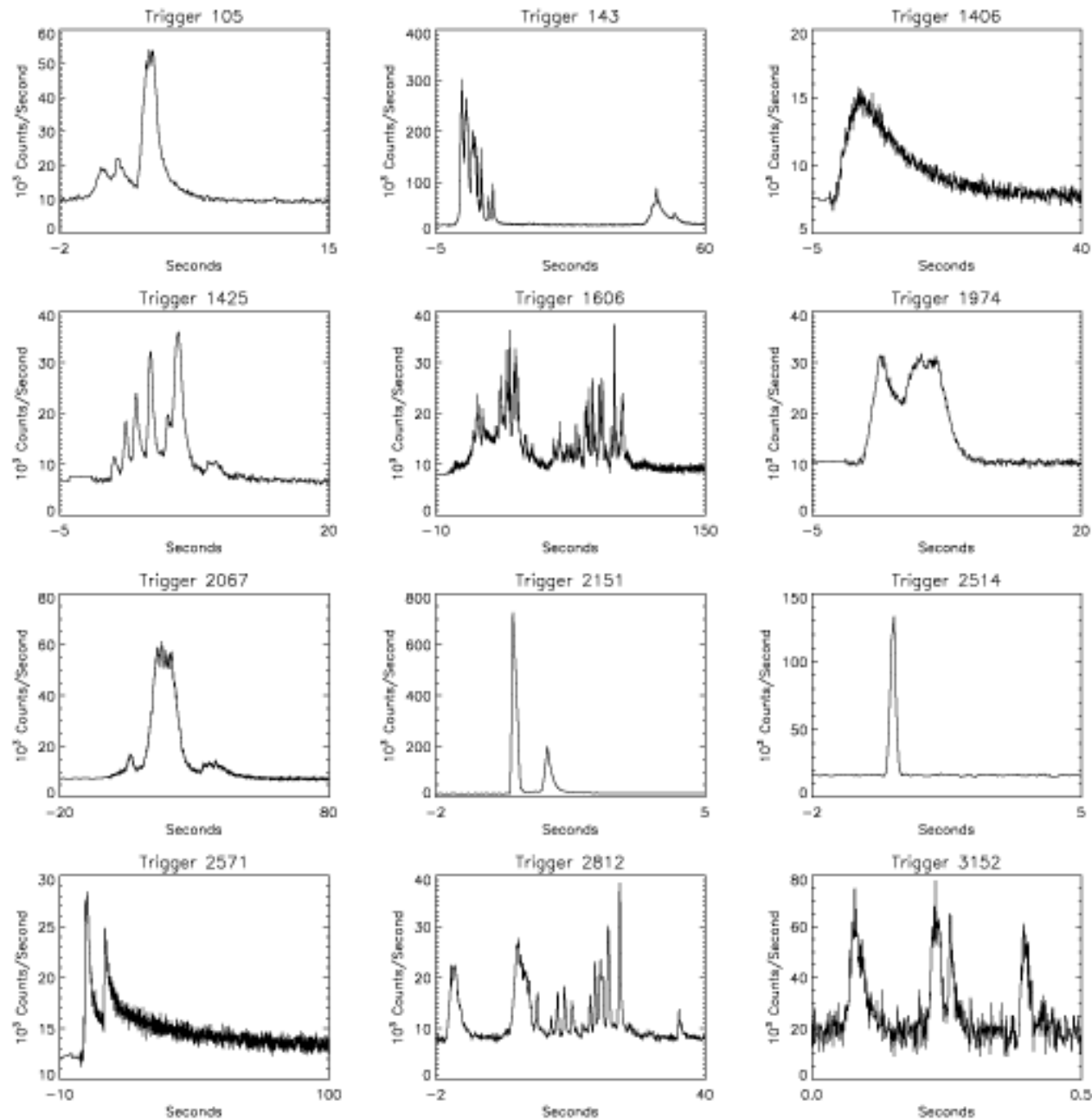
Gamma-ray bursts

Discovered during the cold war

2704 BATSE Gamma-Ray Bursts



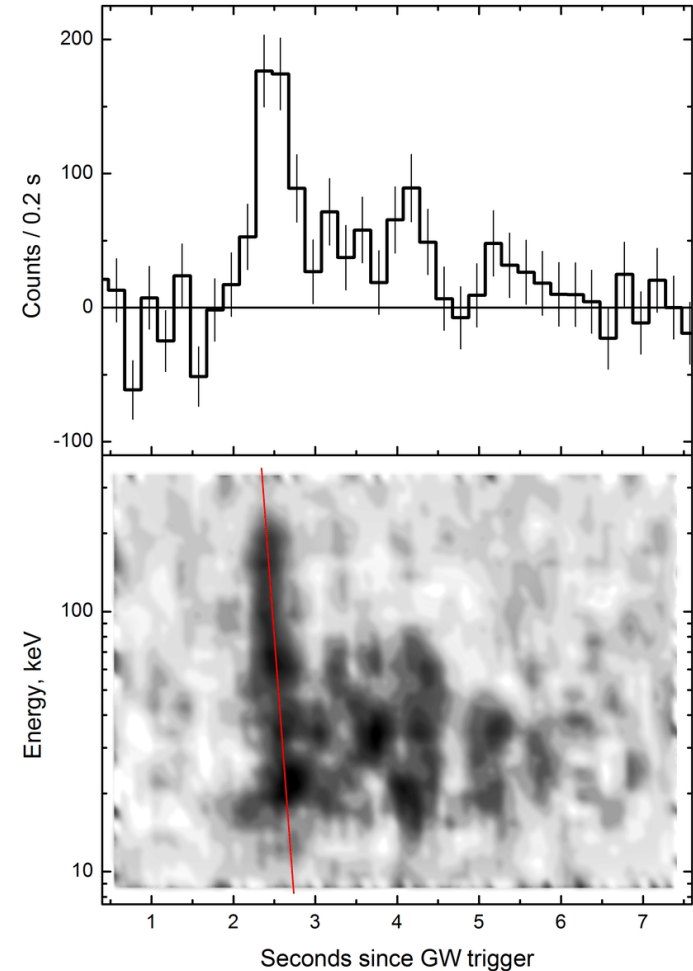
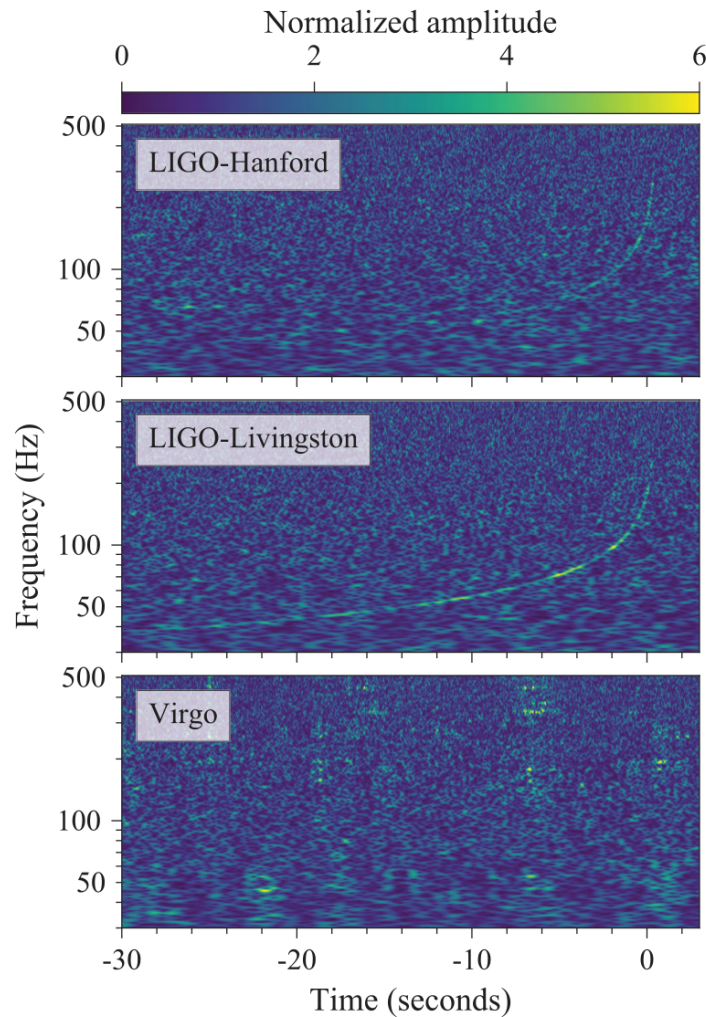
Gamma-ray bursts



(Credit: J.T. Bonnell (NASA/GSFC))

The kilonova

GW170817: gravitational wave event



**Associated with short gamma-ray burst
GRB 170817A**

*By LIGO Scientific Collaboration and
Virgo Collaboration -*

Pozanenko et al 2017

The kilo nova, double neutron star merger

