Noise hunting and detection of gravitational waves with LIGO and Virgo



<u>Pia Astone</u>, Sergio Frasca, Ornella Piccinni, Lorenzo Pierini collaborazione Virgo









LIGO/Virgo Catalog paper



GRAVITATIONAL-WAVE TRANSIENT CATALOG-1



Dec. 2018. https://dcc.ligo.org/LIGO-P1800307/public



Project Virgo_DA number 1

Mainly working with: Ornella J. Piccinni, Sergio Frasca



Detector characterization of LIGO and Virgo

- Do you want to deal with **real** detector data?
- Are you thrilled by the idea to take part to real noise investigation?
- Spectral disturbances can disguise as signals
- Our mission is to identify them and possibly eliminate its source
- DetChar is fundamental for signal detection What are you waiting for?
 Join the lab and learn how to become a noisebuster!



Project Virgo_DA number 2



Mainly working with: Lorenzo Pierini, Pia Astone, Sergio Frasca

Properties are inferred by matching the data with predicted waveforms. Here example with GW170814



→ The analysis is typically done using banks of matched filters

How to enhance Signal-to-Noise-Ratio by image filtering?



What you will learn with this activity

- Gravitational wave experiments and the basic analysis procedures used by LIGO/Virgo
- Data mining and noise characterization
- Methods to extract signals from noise
- Fourier transform in one and two dimensions
- Image analysis
- Matlab programming

....we live highly exciting times...

VIR







The Virgo Rome group (+ S. D' Antonio, Rome 2)

Picture credit: Akshat Singhal