Low frequency detectability of Gravitational wave at the Mátra mountains

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ASD Acr [[m/c^2]/Sr

Overview • Introduction • GW waveform • Seismic data and the transfer function • Results Supported BY the ÚNKP-18-3 New National Excellence

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- How to compare sites?
 - Which is better? Why?
- Percentiles or modes?
 - Use rms values?
- The detectability time dependent (time dependent noises and disturbances)



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Frequency [Hz]

ASD Acc [(m/s^2)/Sqrt(Hz)]



- To estimate early warning possibilities
- Study the low frequency regime (1-7 Hz)
 - Focusing earlier part of the signal

- To estimate early warning possibilities
- Study the low frequency regime (1-7 Hz)
- To minimalize the effects of time dependent noises and disturbances
 - 1y data taking period used
 - 1 GW signal per hour
- Estimate SNR based on "real" seismic data
 - Use transfer functions of suspension system
 - Estimate NN

GW waveform used

- M1 and M2 between 1.2 2.0 solar mass
- $\tau \simeq 2.18 \, {\rm s} \, \left(\frac{1.21 M_\odot}{M_c} \right)^{5/3} \left(\frac{100 \, {\rm Hz}}{f_{\rm gw}} \right)^{8/3}$

M. Maggiore: Gravitational Waves

- Time to coalescence between 0.4 166 hour
- The used waveform $\tilde{h}(f) = \left(\frac{5}{2}\right)^{2}$

$$\tilde{h}(f) = \left(\frac{5}{6}\right)^{1/2} \frac{c}{2\pi^{2/3}r} \left(\frac{GM_c}{c^3}\right)^{5/6} f^{-7/6} e^{i\Psi} Q(\theta,\phi;t)$$

• And $Q = 1, \Psi = 0$ selected

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Frequency [Hz]

- -

Possible early warning



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Seismic data

- The usual seismic data are the ASD
- 1 year of data studied (Matra mountain range)
- No data filter (just Nuttal window function)
- Calculated each $327.68s = 32 \cdot 1024/100Hz$
- $\Delta f = 3.0515715 mHz$









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In Workshield





Further ideas

- Use more than one seismometer to estimate a more realistic NN curves (in progress)
- Study the TtC-GWd curves to study which seismic averages fit best for the results of the long data taking period
 - Short seismic disturbances modify long term seismic spectrum, therefore averages methods influence detectability
 - Mode vs median
- Study the effects of different suspension system

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