## The influence of low frequency magnetic noise on gravitational wave detector

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#### Schumann resonance



Averaged power spectrum from Hylaty Station (2007) http://www.oa.uj.edu.pl/elf/

#### Schumann resonance

- Predicted by Schumann in 1952
- Electromagnetic cavity between Earth's surface and ionosphere
- Electromagnetic waves interferes and create standing wave
- Caused by the electric discharges in our atmosphere



# **ELF Group in Poland**

- Three Cracow institutions Astronomical Observatory of the Jagiellonian University (JU), Faculty of Electronics of the AGH University of Science and Technology (AGH) and Institute of Nuclear Physics of the Polish Academy of Sciences (INP).
- World ELF Radiolocation Array WERA:

Hylaty (Bieszczady, Poland)

Hugo (Colorado, USA)

Patagonia (Argentina)

• Details → http://www.oa.uj.edu.pl/elf/

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- If they would been seen in gravitational channel...

## Storm in Corsica

- 12.12.2009 23:36:56 UTC
- The most powerful event observed by Cracow group



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### **Corsica jet in VIRGO**



#### Corsica jet in LIGO



LIGO-Hanford magnetometer



LIGO-Livingston magnetometer



Virgo magnetometer



Virgo output port



### Systematic search

- Data from science runs S6 and VSR2/3
- 2.5 months of data between 19.10.2009 r. 08.01.2010 r. (940003217 - 946990984)
- We analyzed magnetic channels of Virgo i LIGO
- We looked for a time coincidences (0.25s window)
- Times slides as a background estimation (80 slides form -5s to +5s)

#### Results – LIGO L1 i H1



# Results – LIGO H1 i Virgo



## **Summary and Conclusions**

- Gravitational waves detectors are affected by low frequency magnetic noise
- Magnetic noise in different GW detectors sites is correlated
- There is no evidence that any magnetic event during S6 and O1 caused triggers in GW channel
- Advanced detectors are more sensitive to the lower frequencies, so we need to monitor that phenomena.
- Details: Kowalska-Leszczynska et al. 2017 (http://adsabs.harvard.edu/abs/2017CQGra..34g4002K)