

# Gravitational Wave Physics at the VUB



VRIJE  
UNIVERSITEIT  
BRUSSEL

# HOW IT STARTED

January 30-31 2018: (COSPA) meeting at Liège

- First discussions with Dutch colleagues
- Need for a prototype?

Back to the VUB:

- Physics Department: **HEP@VUB** (High Energy Physics Research Centre)
- Faculty of Engineering: **B-PHOT** (Brussels Photonics)



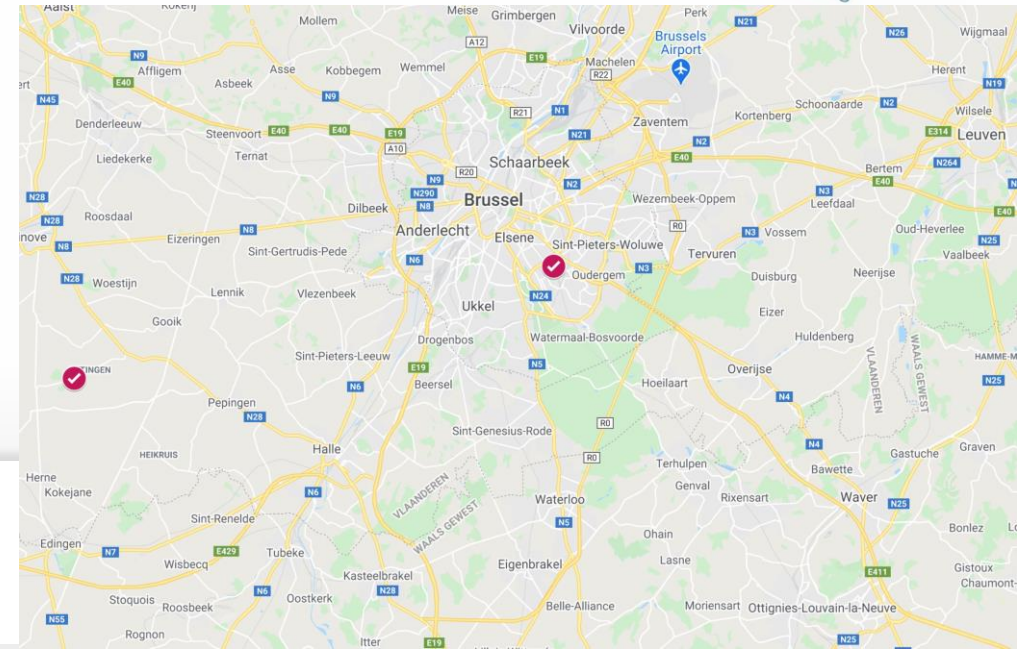
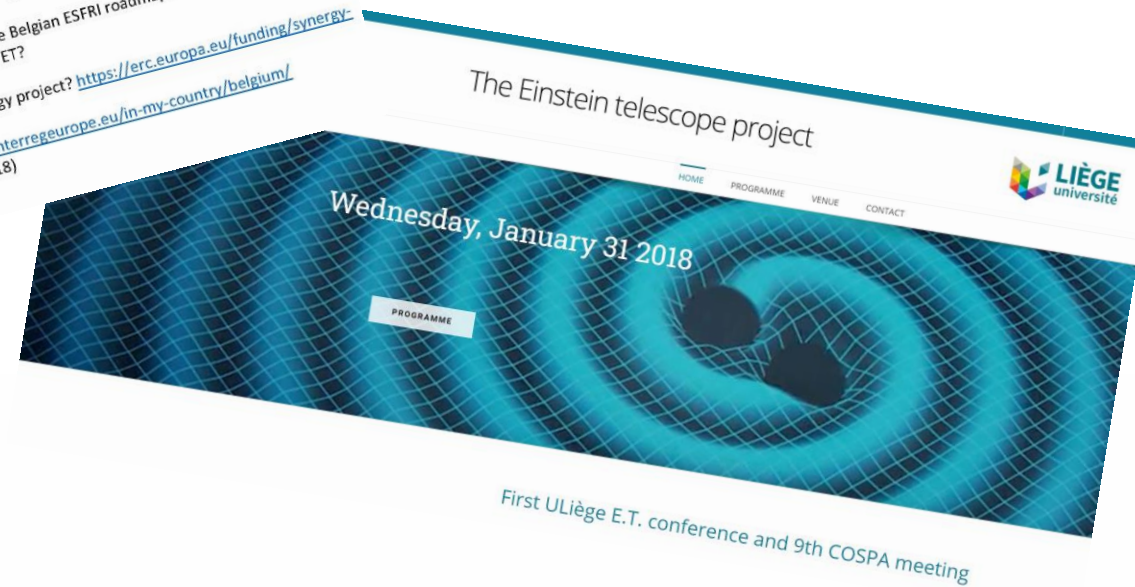
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- Agenda for January 30th afternoon meeting
1. What is the todo list for the Einstein telescope and who can do what?
  2. Opportunity to have MoU between Belgian, Dutch and German universities and Laboratories.
  3. How can we push for ET to be on the Belgian ESFRI roadmap?
  4. Is participating in Virgo the road to ET?  
<https://erc.europa.eu/funding/synergy-grants> (Nov 2018 deadline?)
  5. Should one prepare an ERC synergy project?  
<https://www.interreurope.eu/in-my-country/belgium>
  6. Interreg money? <https://www.interreurope.eu/in-my-country/belgium> Fourth call (May - mid-June 2018)
  7. FWB money: ARC?

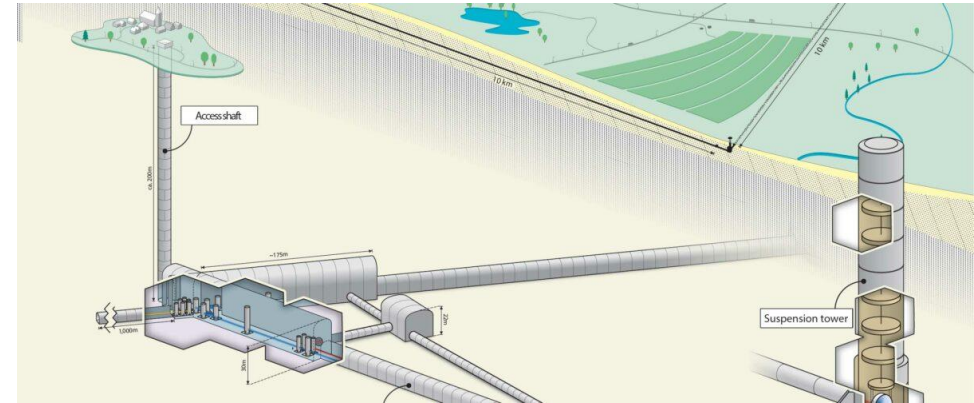


# VUB & GRAVITATIONAL WAVES

Focus on:

- **Instrumentation**  
Einstein Telescope (eg ESFRI),  
ETpathfinder
- **Physics**  
Virgo (SBGW: theory and  
data analysis)

In very close  
collaboration with:



Images: ET & ETpathfinder colls.

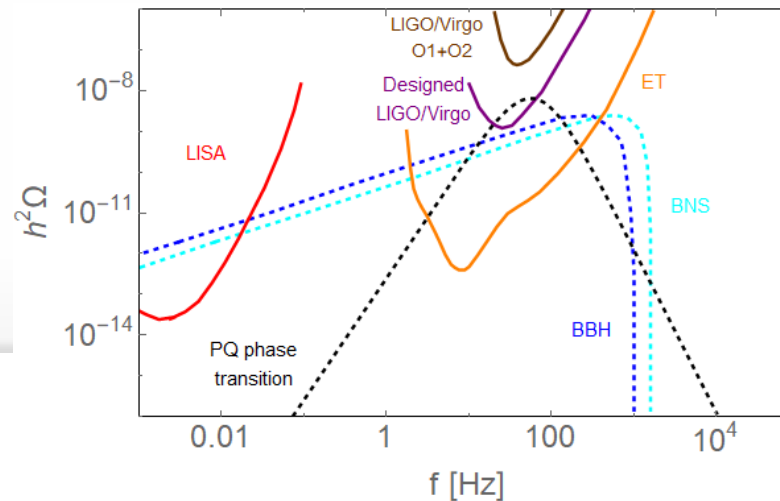
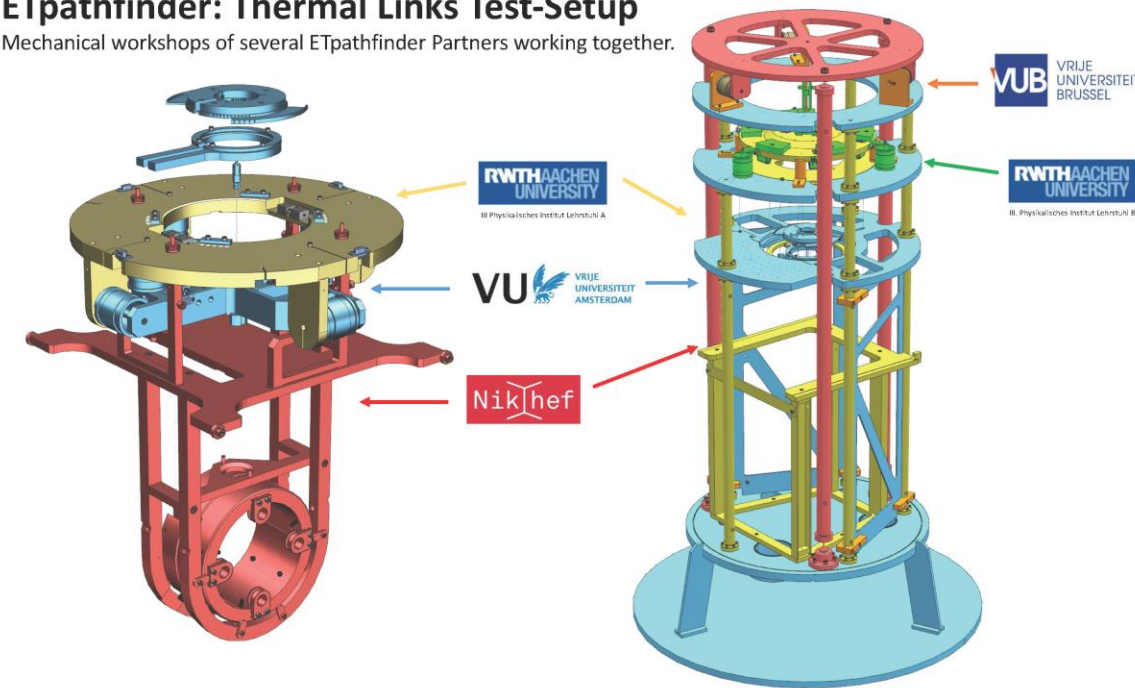


Image: K. Turbang

## ETpathfinder: Thermal Links Test-Setup

Mechanical workshops of several ETpathfinder Partners working together.



## INSTRUMENTATION

### ETPATHFINDER

The VUB is together with the NIKHEF, Maastricht University, Eindhoven University, the UAntwerpen, the KULeuven and the UGent, one of the f(ounding) partners of **ETpathfinder** (R&D center for the development of cryogenic Si based optics for Einstein Telescope), ULiège and UCLouvain are satellite partners.

- **WP6 Optics:** prototyping, polishing and characterization of (freeform) Si mirrors; study and manufacturing of optical beam shaping elements for non-Gaussian laser beams; optomechanical analysis of optical systems.
- **WP5 Seismic Isolation:** development of suspension fibers together with sensors for rotational and torsional movements.

Images: S. Hild



Start Construction: April 2020



Drilling 170 pillars



July: ~1000 t of concrete poured



Oct : First cleanroom walls being installed.

Cleanroom in operation ~ March 2021

# INSTRUMENTATION

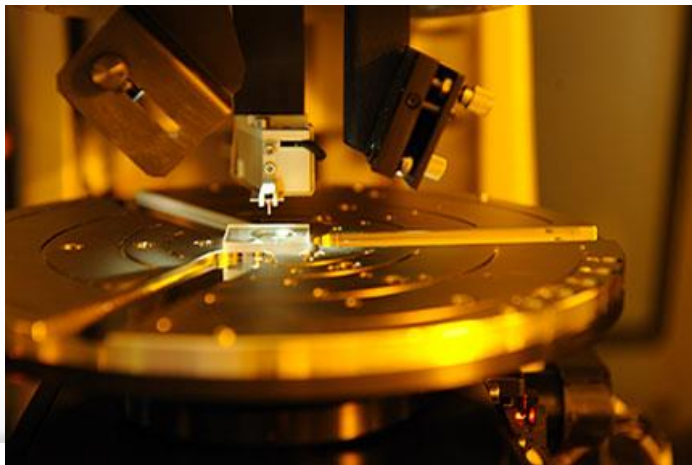
## ETPATHFINDER



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This is performed by the “Brussels Photonics” team, B-PHOT, partially housed at the “Photonics Innovation Center” (Gooik) where a state-of-the-art pilot line for advanced (freeform) optics is being exploited. Optical design, prototyping, replication and metrology come together in this advanced facility.

People involved: *Fabian Duerr, Lien Smeesters, Hugo Thienpont, Jürgen Van Erps, Michael Vervaeke & Alexander Sevrin*



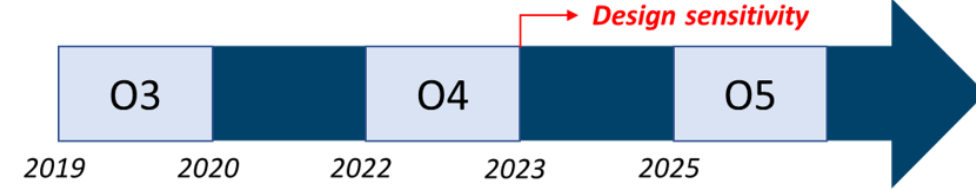
Images: B-PHOT

# PHYSICS

## SBGW



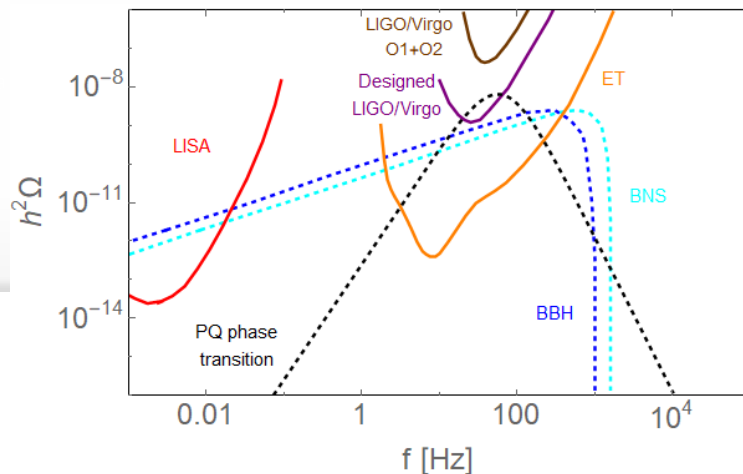
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Activities centered around the stochastic gravitational waves background, most people involved are members of the stochastic subgroup of LVK (and members of **BelGrav**).

- Towards the discovery of the **astrophysical SBGW** @ LVK: development of analysis techniques, data analysis, ...
- Modeling of the **cosmological SBGW** sourced by e.g. strong 1<sup>st</sup> order phase transitions in the early universe, cosmic strings, domain walls, ...

People involved: *Simone Blasi, Alberto Mariotti (Virgo), Mairi Sakellariadou (LIGO), Kevin Turbang (Virgo) and Alexander Sevrin (Virgo)*



In collaboration with



Image: Kevin Turbang

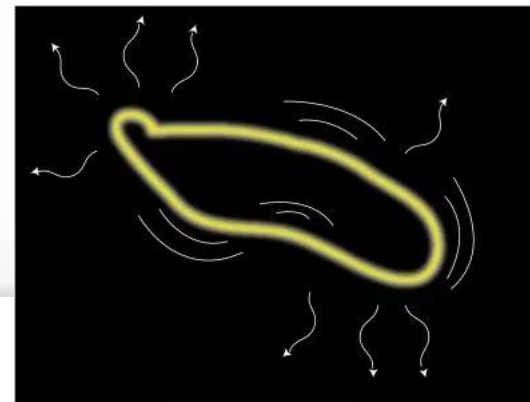


Image: Matt DePies/UW

## CONCLUSION

The VUB group involved in gravitational physics is young but diverse in its activities and rapidly growing. The VUB is committed to further invest in this fascinating and promising field.



Images: Virgo collab.; VUB; ET collab.

