Ultra-High-Frequency GWs

Where to Next?

Living review update
Session II
Ultra-High-Frequency GWs
Where to Next?
Monumental innovation project

STAGE-GATE MODEL

divergent phase

idea generation

technological opportunities
Monumental innovation project

STAGE-GATE MODEL

divergent phase

idea generation

idea development and feasibility analysis

convergent phase

technological opportunities
Monumental innovation project

STAGE-GATE MODEL

divergent phase

idea generation

idea development and feasibility analysis

development and design

technological opportunities

convergent phase
Monumental innovation project

STAGE-GATE MODEL

divergent phase

idea generation

idea development and feasibility analysis

development and design

prototypes and testing phase

convergent phase

technological opportunities
Monumental innovation project

STAGE-GATE MODEL

divergent phase

idea generation
idea development and feasibility analysis
development and design
prototypes and testing phase
actual experiment
construction

convergent phase

technological opportunities
Monumental innovation project

STAGE-GATE MODEL

divergent phase

ideagenetration
idea
development and feasibility analysis

development and design

prototypes and testing phase

actual experiment construction
data taking

convergent phase

technological opportunities
Monumental innovation project

STAGE-GATE MODEL

Divergent phase
- Idea generation
- Idea development and feasibility analysis

Convergent phase
- Development and design
- Prototypes and testing phase
- Actual experiment construction
- Data taking

Technological opportunities
- Heterodyne detection
- Ellipticity detection
- Graviton detection
- Pulsed lasers
- Atomic precision measurements

Axion haloscopes
- BAUSCIA
- MAGE
- Axion haloscopes
- SRF cavities
- ALPS
- BAWs

Timelines?
Monumental innovation project

STAGE-GATE MODEL

Divergent phase:
- Idea generation
- Idea development and feasibility analysis
- Development and design
- Prototypes and testing phase
- Actual experiment construction
- Data taking

Convergent phase:
- Technological opportunities
- Heterodyne detection
- Ellipticity detection
- Graviton detection
- Pulsed lasers
- Atomic precision measurements
- Axion haloscopes
- BAUSCIA
- SRF cavities
- MAGE
- Axion haloscopes
- Levitated sensor
- ALPS
- BAWs
Collaborative innovation
Collaborative innovation

External factors
- Relevant theory inputs
- Technological opportunities

→ collaborative innovation
Collaborative innovation

Facilitating factors
- Compatible goals
- Reciprocal trust and absence of opportunistic behaviours
- High-quality communication
- Constructive commitment
- Perception of equity in the share of risks and benefits

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collaborative innovation

Opposition factors
- Physical and technical barriers
- Complexities of coordinating international efforts
- Fear of losing control over a field or a technology
- Frustration if not all partners are equally committed
- Perception of inequity
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Results
- Speed up of the process
- Risk sharing
- Cost sharing
- Higher innovation rate
A path to the holy grail

$$h = 10^{-21}$$

continuous involvement of new students and people

$$h = 10^{-35}$$
A path to the holy grail

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continuous involvement of new students and people

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workshops and dissemination
A path to the holy grail

- continuous involvement of new students and people
- workshops and dissemination
- grant applications, partnerships?

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A path to the holy grail

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workshops and dissemination

grant applications, partnerships?

spin-offs?

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A path to the holy grail

$h = 10^{-21}$

continuous involvement of new students and people

workshops and dissemination

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spin-offs?

dedicated research groups and centers?

SQMS brings together more than 500 experts from 30 partner institutions—national laboratories, academia and industry—in a mission-driven, multidisciplinary collaboration that integrates deep expertise in quantum information science, material science, applied and theoretical superconductivity, computational science, particle and condensed matter physics, cryogenics, microwave devices and controls engineering, industry applications and more.
A path to the holy grail

- Continuous involvement of new students and people
- Workshops and dissemination
- Grant applications, partnerships?
- Spin-offs?
- Dedicated research groups and centers?

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New structure of the review

1. Introduction

2. Setting up the Notation: Comparing Different GW Sources and Detectors - (sarellis@protonmail.com)

3. Sources
   3.1 Late Universe - Gabriele Franciolini (gabriele.franciolini@cern.ch)
   3.2 Early Universe - Andreas Ringwald (andreas.ringwald@desy.de)

4. Detection of Gravitational Waves at High-Frequencies - Axel Lindner (axel.lindner@desy.de)
   4.1 Laser Interferometers and Resonant Mass Detectors and Their Limitations
   4.2 Modern resonant mass detectors - Diego Blas (dblas@ifae.es)
       4.2.1 Optically Levitated Sensors
       4.2.2 BAWs
       4.2.3 GW deformation of microwave cavities
   4.3 GW-EM conversion in the lab - Sung Mook Lee (sungmook.lee@yonsei.ac.kr)
       4.3.1 Light shining through a wall
       4.3.2 SRF cavities
       4.3.3 Axion haloscopes
       4.3.4 High energy pulsed lasers
       4.3.5 Others
   4.4 Astrophysical and cosmological detection concepts - Jamie McDonald (jamie.mcdonald@manchester.ac.uk)
   4.5 Alternative concepts - Asuka Ito (asuka.ito@kek.jp)
   4.6 Summary of detector sensitivities - TO BE REVISED
   4.7 Cross-correlation detectors - Giancarlo Cella & Kristof Schmieden (giancarlo.cella@pi.infn.it, kschmied@cern.ch)

5. Conclusions
Thank you all!