White paper:
4: Detection of gravitational waves at high frequencies
Theories of innovation emphasize the role of social networks and teams as facilitators of breakthrough discoveries\(^1\). Around the world, scientists and inventors are more plentiful and interconnected today than ever before\(^4\). However, although there are more people making discoveries, and more ideas that can be reconfigured in new ways, research suggests that new ideas are getting harder to find\(^5\)\(^6\) — contradicting recombinant growth theory\(^7\)\(^8\). Here we shed light on this apparent puzzle. Analysing 20 million research articles and 4 million patent applications from across the globe over the past half-century, we begin by documenting the rise of remote collaboration across cities, underlining the growing interconnectedness of scientists and inventors globally. We further show that across all fields, periods and team sizes, researchers in these remote teams are consistently less likely to make breakthrough discoveries relative to their on-site counterparts. Creating a dataset that allows us to explore the
White paper:
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Some ideas for guidelines from discussions with Nancy Aggarwal, Sung Mook Lee, Christoph Reinhardt.

• With many new detector proposals coming up (especially due to the axions-HFGW synergies) the white paper cannot sketch all concepts in detail.

• It should focus (similar to the 2020 edition) on basic concepts and exemplary setups, based on published information.

• The presentation of the concepts should ease novices to the HF-GW field to connect with their experimental expertise.

Proposal: table on the next slide.
Levitated sensor

ALPS II

ABRA

Bulk acoustic wave

Physics process

Length change

Magnetic conversion

Physics signal

Magnetic field generation

Length change

Interference of counterpropagating light waves

Sensing signal

Magnetic conversion

Sensing

Movements of levitated nano-particle

Sensing signal

Induced current

Sensing signal

Piezoelectric effect

Signal amplification

Sensing

Resonance with trapping frequency of levitated sensor

Frequency / Q tuning

Signal amplification

Frequency / Q tuning

Mechanical resonance of bulk mass

Frequency / Q tuning

Intra -cavity circulating power, laser light cooling, different levitated sensors

Frequency / Q tuning

Different modes, different sensors

Frequency / Q tuning

Sensing

Interferometric measurement of levitated sensor movement

Sensing

Heterodyne, correlation, photon counting

Sensing

SQUID-based low current sensing, wave form templates

Sensing

SQUID-based low current sensing

Axel Lindner
<table>
<thead>
<tr>
<th></th>
<th>Levitated sensor</th>
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<th>ABRA-grav</th>
<th>Bulk acoustic wave</th>
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<tbody>
<tr>
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</tr>
<tr>
<td>Physics signal</td>
<td>Interference of counterpropagating light waves</td>
<td>Magnetic conversion</td>
<td>Magnetic field generation</td>
<td>Change of shape of testmass</td>
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<td>Induced current</td>
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Proposal:
- Start 4.1, 4.2, 4.3, 4.5 with an introduction based on a table similar to the one shown before.
- Shall we have a new section for 4.4 (Astrophysical & cosmological detection concepts)?
Beyond the white paper (?)

• Appendix on experimental details? Website?
• Do we need to agree on some common data format to simplify combination of different experiments? Do we need a common approach towards “public data and public science”?
• How to deal with longer-term data storage? Is there a minimal down-sampling frequency below which data become “useless”?
• Could the experimentalists try to coordinate their data taking times?
• …