White paper:
4: Detection of gravitational waves at high frequencies

Article

Remote collaboration fuses fewer breakthrough ideas

https://doi.org/10.1038/s41586-023-06767-1

Received: 21 June 2022

Accepted: 19 October 2023

Published online: 29 November 2023

Check for updates

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Theories of innovation emphasize the role of social networks and teams as facilitators of breakthrough discoveries[1–4]. 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

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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.

Physics process
Physics signal
Sensing signal
Signal amplification
Frequency / Q tuning
Sensing

	Levitated sensor	ALPS II	ABRA-grav	Bulk acoustic wave
Physics process	Length change		Magnetic conversion	Length change
Physics signal	Interference of counterpropagating light waves	Magnetic conversion	Magnetic field generation	Change of shape of testmass
Sensing signal	Movements of levitated nano-particle		Induced current	Piezoelectric effect
Signal amplification	Resonance with trapping frequency of levitated sensor	Cavity Q or broadband	none	Mechanical resonance of bulk mass
Frequency / Q tuning	Intra-cavity circulating power, laser light cooling, different levitated sensors	Cavity frequency or broadband	broadband	Different modes, different sensors
Sensing	Interferometric measurement of levitated sensor movement	Heterodyne, correlation, photon counting	SQUID-based low current sensing, wave form templates	SQUID-based low current sensing

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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?
- …