Ultra-High-Frequency GWs
Where to Next?
Challenges and Opportunities of High Frequency Gravitational Wave Detection
14 - 16 October 2019, Miramare - Trieste, Italy

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Challenges and Opportunities of Gravitational Wave Searches at MHz to GHz frequencies


Abstract

The first direct measurement of gravitational waves by the LIGO/Virgo collaboration has opened up new avenues to explore our Universe. This white paper outlines the challenges and gains expected in gravitational wave searches at frequencies above the LIGO/Virgo band, with a particular focus on the MHz and GHz range. The absence of known astrophysical sources in this frequency range provides a unique opportunity to discover physics beyond the standard model operating both in the early and late Universe, and we highlight some of the most promising gravitational sources. We review several detector concepts which have been proposed to take up this challenge, and compare their expected sensitivity with the signal strength predicted in various models. This report is the summary of the workshop Challenges and opportunities of high-frequency gravitational wave detection held at ICTP Trieste, Italy in October 2019.
A few numbers

Number of Papers Published Per Year

Histogram of arXiv Categories
A few numbers

O(10) of new experimental concepts
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Why an update?

To have an up-to-date reference for the field that can benefit the community
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Rules to update

- All the authors from the previous version will be included in the new one.
- We can (moderately) add names to the author list.
- Both versions will be online in the journal, linked to each other.
Our guidelines

- Add references mindfully.
- On the theory side, focus on the most promising sources, especially those above the BBN bound (late Universe sources).
- Old authors will be consulted to update their sections.
- We will put one or two coordinators in charge of each section.
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At this stage new authorship requires a substantial contribute to the update of the review.
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- New section: ‘EM-GW conversion detectors’, Axel Lindner & Sung Mook Lee
- New section: ‘new resonant bars’, Diego Blas
- New section: ‘miscellaneous’, Asuka Ito
- Revisit
- New section: ‘Astrophysical and Cosmological concepts’, Jamie McDonald
Ideas, comments or suggestions?

![A diagram illustrating various gravitational wave sources and their detection sensitivities.](image)

- **Characteristic Strain**
  - **Frequency/Hz**
    - $10^{-12}$
    - $10^{-14}$
    - $10^{-16}$
    - $10^{-18}$
    - $10^{-20}$
    - $10^{-22}$
    - $10^{-24}$

- **Inspirals**
  - Extreme mass ratio inspirals
  - Resolvable galactic binaries
  - Unresolvable galactic binaries

- **Binary Inspirals**
  - Massive binaries
  - Supermassive binaries

- **Gravitational Wave Detectors**
  - LISA
  - IPTA
  - SKA
  - BBO
  - DECIGO
  - TianQin
  - aLIGO

- **Sources**
  - Compact binary inspirals
  - Core collapse supernovae
  - Pulsars
  - Type Ia SN

- **Stochastic background**
  - Stochastic background of supermassive binaries

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**Note:** This diagram illustrates the sensitivity of various gravitational wave detectors to different frequency bands, highlighting the types of binary inspirals and sources they can detect.