WG3 and WG4 Podium

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WG3: Fundamental problems in high-energy and gravitational physics

David Keitel, Elisa Maggio

Questions on tests of general relativity

- How to tell a deviation of GR from waveform systematics, noise and environmental effects?

- Numerical relativity beyond GR: how far can we go?

- Is waveform generation in modified gravity feasible for an efficient confrontation against GW data?

- Can we model EMRIs to high accuracy in alternative theories of gravity?

Questions on quantum gravity

- What is the most promising imprint of the quantum nature the spacetime in gravitational waves?

- What can we learn about the remnant from a non-observation of echoes?

- Can we simulate the formation of horizonless compact objects?

- Are all black holes the same?

Questions (from the presentation)

- How to extract fundamental physics from CW observations?
- How will GW detectors compete with other DM detection efforts?
- What other multimessenger opportunities should be explored?
- How to extract detailed information from SGWBs and control model degeneracy?
- What other remnants from the early Universe can we find at very low (or maybe very high!) frequencies?

Questions (from the spreadsheet)

- What else do we want to search for that LISA or 3G enables but that will not already be ruled out by the late 2030s?

- What can we learn about fundamental physics by detecting or constraining any stochastic GW background from the early universe?

Bonus question

- How should all these questions influence 3G detector design?
(e.g. would some of the more exotic ideas work better with
a triangle ET than with 2L?

WG4: Gravitational waves and Cosmology

Simone Mastrogiovanni, Carlo Tasillo

Questions (from spreadsheet and previous discussions)

- Engage with us using the QR code below or following the link on your laptop

Follow this link

Question 1 (pool)

I think that…

- GW sources are **really** competitive probes to discover new physics in the **local** ($z<0.25$) Universe
- GW sources are **really** competitive probes to discover new physics in the **all** the Universe
- GW sources could discover new physics at cosmological scales **only if aided by other probes**, e.g. LSS surveys
- I want to forget about cosmology with GWs

Question 2 (ranking)

The next discovery in the context of GW cosmology is…

1. Deviations of GW propagation at cosmological scale
2. A binary neutron star like GW170817 with extra info about EM counterparts (e.g. inclination angle from afterglow)
3. A comprehensive understanding of the link between FRB, long/short GRB with compact binaries
4. The binary black hole mass spectrum is evolving in redshift
5. A binary black hole with electromagnetic counterpart (e.g. AGN flare) that can allow the measure of the dark matter fraction.
6. Sub-solar mass compact binary consistent with primordial black hole formation
7. GW-based measure of the Hubble constant at $<5\%$ precision.
8. Discovery of the correlation between galaxy properties and GW emission
9. Lensing of a Gravitational Wave signal, opening of lensing cosmology

Question 3 (cloud words)

To achieve accurate and precise GW cosmology with XG detectors we need to better understand...

What’s the (dominating) source of the PTA signal?

Supermassive black hole binaries or new physics?

If it’s supermassive black holes, how can we overcome the final parsec problem?

Is there a need for new physics?

If it’s a phase transition: Which SM extension is okay with cosmological constraints?

(Big Bang Nucleosynthesis and the Cosmic Microwave Background constrain the amount of energy residing in dark sectors)

How can we subtract the astrophysical background to search for a cosmological one?

Will we be able to probe gravitational wave amplitudes down to Omega ~ 10^(-16) as promised by SKA?

What kind of analysis pipeline should we use for disentangling different GW backgrounds?

Is a Bayesian framework as used by the PTA collaborations what we need? How can we ensure fair model comparisons?