

## ICASU Panel discussion

INSPIRAL

RINGDOWN

MERGER

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# Challenges for testing gravity

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Motivation to consider gravity theories beyond GR

- Cosmological observations (DE/DM, Hubble/ $S_8$  tension, etc.)
- Black hole information paradox
- Quantum gravity

Constructing gravitational wave templates in extended gravity scenarios

- Modified nature of black hole horizon (ECO).
- Higher dimensional operator corrections (EDGB, CS).
- Low energy extra degrees of freedom that evades all the weak gravity tests (Screening mechanism, Parity odd, Very weakly interacting with matter).

## Challenges

- For extreme mass-ratio inspirals, even GR templates are not ready yet.
- Theoretical predictions of the waveform for binary coalescence in extended gravity theories are very limited.

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- ❶ Is there any reason to think that GR +  $\Lambda$ CDM is wrong? (other than a few anomalies)  
Or are people mainly just hoping for more?
- ❷ What measurements are going on right now or in the near future that are most likely to discover new physics that they aren't looking for?
- ❸ What is our guiding principle?  
Should theory guide the search for new physics or  
should (surprising) observations guide the search for new theories?
- ❹ What are the most surprising or exciting connections in science?  
E.g., double-copy and scattering amplitudes for GWs; AdS / CFT;
- ❺ Where in the GW spectrum would you build the next detector (beyond LISA / 3G)?