

**iTHEMS Cosmology Forum
n°2 - Stochastic gravitational
waves: fossils from the early
universe**

Report of Contributions

Contribution ID: 2

Type: **not specified**

(Keynote) Opening a new door: Nano-Hertz Gravitational-Wave Astronomy

Friday, September 27, 2024 9:30 AM (1h 15m)

Pulsar timing array is an experiment to detect gravitational waves with a frequency of nanohertz by accurate long-term observation of pulsars. It will not only open a new door for cosmology and astrophysics but also pave the way for multi-wavelength gravitational-wave astronomy. However, pulsar timing array suffers from various systematic errors such as dispersion delays caused by interstellar plasma and uncertainty in the position and motion of solar system objects, which inhibit detection of gravitational wave signals. Recently, there have been signs of gravitational-wave background through appropriate modeling of systematic errors and correlation between pulsars. The estimated power spectrum of gravitational wave background is consistent with one from supermassive black hole binaries, but other possibilities such as secondary generation due to density fluctuations and inflation are not excluded. In this talk, I cover the principles of pulsar timing arrays, data analysis methods and the physical interpretation of recent results. In addition, I introduce the Indian Pulsar Timing Array, which is a joint project by Japan and India.

Presenter: Dr TAKAHASHI, Keitaro (Kumamoto University)

Contribution ID: 3

Type: **not specified**

Supermassive black hole formation: insights from astrophysical simulations

Friday, September 27, 2024 10:45 AM (1 hour)

Supermassive black holes (SMBHs), with masses exceeding 10^6 solar masses (M_{sun}), are believed to reside at the centers of nearly all galaxies and significantly influence their host galaxies through the so-called “co-evolution” of galaxies and SMBHs. However, the origin of SMBHs remains a mystery and a major challenge in modern astronomy. In this talk, I will first review the current status of cosmological simulations trying to reproduce the co-evolution of galaxies and SMBHs. Then, I will present numerical studies that focus on the formation of SMBHs with masses around $10^6 M_{\text{sun}}$, which are considered the starting point of the subsequent growth toward heavier SMBHs.

Presenter: Dr SUGIMURA, Kazuyuki (Hokkaido University)

Contribution ID: 5

Type: **not specified**

First-order phase transitions and gravitational wave production in the early Universe

Friday, September 27, 2024 1:30 PM (1 hour)

Presenter: Dr JINNO, Ryusuke (Kobe University)

Contribution ID: 6

Type: **not specified**

Scalar-induced gravitational waves as a cosmological phonograph

Friday, September 27, 2024 3:30 PM (1 hour)

Our universe has experienced phase transitions/crossovers several times throughout its thermal history. The gravitational wave (GW) as a cosmological phonograph can record and tell us about such history thanks to its high penetration ability. In particular, GWs sourced by oscillations of density contrasts called scalar-induced GWs (SIGWs), have sensitivity not only to the background expansion rate but also to the plasma sound speed and hence could serve more information on crossovers. Furthermore, they are closely related to the exotic astrophysical object: primordial black holes. In this talk, the potential capabilities of SIGWs will be presented with a view to future observations.

Presenter: Dr TADA, Yuichiro (Nagoya University)