1.1 Tsubono Group

Research Subjects: Experimental Relativity, Gravitational Wave, Laser Interferometer

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The detection of gravitational waves is expected to open a new window into the universe and brings us a new type of information about catastrophic events such as supernovae or coalescing binary neutron stars; these information can not be obtained by other means such as optics, radio-waves or X-ray. Worldwide efforts are being continued in order to construct detectors with sufficient sensitivity to catch possible gravitational waves.

TAMA300 is a 300-m baseline laser interferometric gravitational wave detector constructed in Mitaka. We started the operation of the detector in 1999. The achieved sensitivity, $h \sim 3 \times 10^{-21}/\sqrt{\mathrm{Hz}}$ at 700Hz to 1.5kHz, is sufficient to catch possible gravitational wave events in our galaxy. We are now expecting to start the next Japanese large-scale laser interferometer, LCGT.

A space laser interferometer, DECIGO, was proposed through the study of the gravitational wave sources with cosmological origin. DECIGO could detect primordial gravitational waves from the early Universe at the inflation era.

We summarize the subjects being studied in our group.

- Ground based laser interferometric gravitational wave detectors
  - Study of the next-generation laser interferometer, LCGT
  - Design of LCGT
- Space laser interferometer
  - Space laser interferometer, DECIGO
  - DECIGO pathfinder, DPF
  - Laser sensor for DPF
  - FP cavity for DPF
  - DPF gradiometer in space
  - Small size GW detector, SWIM
- Development of a gravitational wave detector using magnetic levitation
  - Gravitational wave detector using superconducting magnetic levitation
  - Magnetic field shielding for levitated detector
- High sensitive laser interferometer using nonclassical light
  - High sensitive laser interferometer using squeezed light
  - Generation of the squeezed light
- Development of the ultra stable laser source
  - Laser stabilization using a cryogenic sapphire cavity
  - Study of the cavity support

references

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