Summary of past researches

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Introduction

Pulsars are stars that emit pulses to the Earth. A gravitational wave detector with many pulsars is called a Pulsar Timing Array (PTA). In June 2023, several PTA groups obtained strong evidence of gravitational waves. In the near future, the first detection of gravitational waves using PTAs may be achieved. Construction of the next-generation radio telescope, the Square Kilometer Array (SKA), began in 2021. The sensitivity of the PTA will be dramatically improved with the completion of the SKA.

Research

I tried to detect the gravitational waves and the dark matter with PTAs. I have been participating in the Indian PTA since 2021.

Results of Research

- **Construction of gravitational wave detection theory**

  In the paper [7], we clarified how the circular polarization of the stochastic gravitational wave background modifies the observed data of the pulsar. We made it possible to detect the circular polarization with PTA.

- **Dark matter search**

  In the paper [6], we tried to detect an ultralight scalar field, one of the dark matter candidates, using PTA. We placed a stronger limit on the amplitude of the ultralight scalar field than previous studies.

- **Estimation of the location of gravitational wave sources**

  In the paper [1], we clarified the impact of accurate distance measurements of pulsars on the source location estimation of a gravitational wave in anticipation of the SKA era. We showed that the source location estimation of a gravitational wave can be improved by accurately measuring the distance of a few pulsars.

- **PTA group**

  I am a member of the Indian PTA [2-5, 8].