

Plans of future research

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Purpose of future research

Currently, the PTA is sensitive enough to detect the stochastic gravitational wave background. In addition, the SKA will increase the sensitivity of the PTA. In the future, it will be very important to use the PTA to unravel the universe.

For example, an analysis by the NANOGrav shows that the amplitude and the spectral index of the stochastic gravitational wave background are slightly different from those expected from black hole binaries, the most likely candidate for gravitational wave sources. Therefore, it is very important to verify gravitational wave sources other than black hole binaries (new physics). The nature of the background gravitational waves is expected to depend on the new physics.

The purpose of future research is to clarify how the stochastic gravitational wave background due to new physics and the dark matter are detected by PTA. Then, we will verify the new physics and dark matter by analyzing the observational data of the PTA.

Subject of future research

In the NANOGrav analysis, inflation, second-order scalar fields, phase transitions, cosmic strings, and domain walls are considered as new physics that emit gravitational waves. In addition to the search for gravitational waves, ultralight dark matter and primordial black holes were also considered. Simplified models were used in these analyses.

The subject of the future research is to clarify the specific properties of gravitational waves due to the new physics and dark matter. Then we will clarify which properties can be tested with PTA.