Research plan

I have been working on theoretical researches for gravitational wave physics so far. I would like to promote these researches to gain a deep understanding of various phenomena in the universe by using gravitational waves, and would like to contribute the progress of gravitational wave astronomy.

I plan to work on the following topics.

Construction of the waveform template for data analysis

The accurate prediction of theoretical waveforms is essential to the matched filtering analysis to search gravitational wave signals. I am planning to work on the construction of waveform templates focusing on binaries with extreme mass ratio, based on the black hole perturbation theory. In addition, I would like to develop a method of data analysis making use of the template bank.

Secular evolution of a spinning particle

In my previous works, I calculated the secular variations of the orbital parameters in Kerr geometry under the adiabatic approximation. The calculation was done assuming the orbiting particle is spinless. To investigate the effect of the particle's spin on the orbital evolution and the emitted gravitational waves, I will extend the calculation to a spinning particle orbiting a Kerr black hole.

Self-force calculation in Kerr geometry

The strategy for calculating the self-force effect in the framework of black hole perturbation theory is as follows:

(1) Calculate the perturbation induced by a particle moving along the background geodesic.
(2) Derive the self-force from the calculated perturbation.
(3) Extract the orbital corrections from the self-force data.

In my previous works, I succeeded to implement the scheme to a numerical code in Schwarzschild case. I would like to extend the implementation to Kerr case.

Black hole observation by ringdown gravitational waves

So far, I studied on a test of general relativity by using ringdown GWs, GW echoes induced by exotic compact objects, and the importance of the overtones to the analysis of ringdown GWs. I would like to consider an application of the results to an analysis by using observed data in order to construct a method of data analysis for accurate observation of BHs.

According to the approval of the Laser Interferometer Space Antenna (LISA) for a L3 mission of European Space Agency in 2017, the international consortium, consisting of scientists involved in LISA, have been reorganized for the future phase of the mission. I participate in the consortium as a member of a science group in the LISA Japan. I would like to contribute the LISA mission through collaborations in the consortium and to show the presence of the Japanese group in gravitational wave astronomy.

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