Observation of Gravitational Waves Predicted by General Theory of Relativity

Using Gravitational Waves to Understand Physics of Black Holes and Nature of High-Energy Astronomical Objects

Professor Nobuyuki Kanda

In February 2016, a US gravitational wave project, LIGO, announced their observation of gravitational waves for the first time in human history. Gravitational waves are wave propagations of the spacetime distortion at light speed as predicted by Einstein using his general theory of relativity. However, they had never been measured directly until this point. So, the first observation of gravitational waves was heralded as a major achievement in the history of physics.

The lab of Professor Nobuyuki Kanda of the Graduate School of Science is one of the main groups involved in the Japanese gravitational wave observation project KAGRA, and the central base for observational data analysis in gravitational wave astronomy. Data recorded by the laser interferometer of the KAGRA gravitational wave telescope built in the Kamioka mine in Gifu prefecture is received by the University's gravitational wave data analysis computer just 3 seconds later. This data is analyzed in an attempt to observe very weak signals of gravitational waves. The ability to observe gravitational waves is expected to enable explication of cosmic phenomena such as black holes, supernova explosions, gamma ray bursts, neutron stars and the inflationary universe.

Professor Kanda's lab hopes to soon be able to observe gravitational waves with the KAGRA detector. The lab's aim is to use observed gravitational waves in studies of the physics of black holes and strong gravitational fields, to describe the nature of the many high-energy astronomical objects existing in the cosmos.

Professor Kanda and associated professor Tagoshi speak at a well-attended press conference to explain the aims of the LIGO project announced by the US.

The gravitational wave data analysis computer at the University

Researchers in Focus

Professor Nobuyuki Kanda,
Graduate School of Science

Professor Kanda earned his degree from an experimental study of elementary particles. He states that at one point in his career, he had studied three of the four basic interactive forces found in nature—electromagnetism, the strong force and the weak force. Gravity (the fourth interactive force) was the only one he hadn't studied directly. So when a project to build a large laser interferometer in Japan arose in the 1990s, Kanda was eager to take part, forming an ambitious wish to become involved in gravity research and thereby complete the 'grand slam' of all four interactive forces. He soon found himself specializing in gravitational wave physics.