Name ：Chihiro MATSUI
Research field：Applied Mathematics
Key words ：Mathematical Physics, Statistical Mechanics,
Quantum Integrable Systems

Present research

Quantum mechanics, which describes the microscopic world, is time-reversal symmetric. However, in our everyday experience, processes such as a cup of coffee cooling down are irreversible: once a change occurs, it does not spontaneously return to its original state. “Why is the microscopic world reversible, while the macroscopic world is not?” Understanding this fundamental question is the central goal of my research.

To address this problem, one needs to analyze the time evolution of systems with many degrees of freedom, which is generally extremely difficult.
Nevertheless, it is known that certain special classes of such systems are exactly solvable despite their complexity. My research focuses on uncovering the underlying mathematical structures that make such solvability possible, and on understanding the physical phenomena that emerge from them.

Notice for the students

A mathematician might feel, “So what?” when a physical phenomenon is explained by equations, but feel that “the world is complete” when a mathematical problem is solved. A physicist, on the other hand, might feel, “So what?” when a mathematical problem is solved, but feel that “the world is understood” when a phenomenon is described by equations. Mathematical physics lies on the ridge between these two seemingly disconnected perspectives.

Students who feel that “mathematical physics sounds somehow interesting” are very welcome.