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**Research field:** Differential equations, Functional Analysis / Real Analysis

**Keywords:** Mathematical physics of quantum mechanics, Schrödinger equation

**Current research:** I am working on differential equations of quantum mechanics, mainly on Schrödinger equations.

The quantum mechanics is formulated as a linear dynamical system, of which the time-evolution is generated by a self-adjoint operator on a Hilbert space. The time evolution is described by the spectral properties of its self-adjoint generator. The generator for the system of finite number of electrons is a partial differential operator called a Schrödinger operator. The eigenvalues of the operator correspond to the *bound states*, and the continuous spectrum corresponds to the *scattering states*, and they have been studied as the *eigenvalue problem* and the *scattering theory* for Schrödinger equations, respectively.

Recently, I am mainly working on two subjects: The first one is the spectral properties of *random Schrödinger operators*, which describe the quantum systems with Ergodic randomness and closely related to the solid state physics. In this model, the potential is given as a random variable, and the spectral properties are studied for *almost all* potentials. The other subject is the analysis of the microlocal singularities of solutions to time-dependent Schrödinger equations. This subject is related to various methods, including microlocal and semiclassical analysis, classical scattering theory and dynamical systems, and is still rapidly developing area of research.

**Prerequisites:** The basic tools in this subject are the functional analysis and the Fourier analysis, and some familiarity with these subjects are essential. It is also desirable to have some knowledge of elementary quantum mechanics.

This subject is a part of *Mathematical Physics*, and many researchers working in this field are educated as physicists. It is essential to have physical intuition and serious interest in the physical phenomena to work in this field. Quite often you have to construct models and methods following the physical picture. Thus I wish to have graduate students with desire to understand the physical phenomena in terms of rigorous mathematics.