Quantum Resonance and Electronic Conduction in Mesoscopic Systems

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I first review our recent work on quantum resonance [1]. We define a resonant state as an eigenstate of the Schrödinger equation. We then discuss physical significance of the resonant eigenstate. We show that the resonant eigenstate does observe the particle number conservation.

I then introduce some of our most recent works:

1. We argue that the Fano resonance, which is often found in the electric conductance of mesoscopic systems as an asymmetric peak, can be explained as interference effect among resonant states and bound states. [Joint work with K. Sasada.]

2. We present an exact expression of a few-body scattering state of a model with electron-electron interaction. The state exhibits a two-body bound state as well as resonance due to the interaction. [Joint work with A. Nishino and T. Imamura.]

3. We discuss the spectrum of resonant states in the complex wave-number plane and the complex energy plane. We show within the Born approximation that the resonance poles for Gaussian scattering potentials are alined along the $-\pi/4$ line in the fourth quadrant of the complex wave-number plane. [Joint work with Prof. K. Katō.]

References

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