量子物理学・ナノサイエンス第 380 回セミナー

Imaging quantum decoherence in nuclear reactions

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場所　：　本館 2 階 290 物理学系輪講室

概　要

In quantum mechanics, when two or more indistinguishable processes are involved, the probability is computed by taking the absolute square of the total amplitude, which is given as a sum of the amplitude of each process. This leads to the interference of each process due to the cross terms. This is referred to as quantum coherence, and this is one of the most fundamental features of quantum mechanics. In heavy-ion elastic scattering, the angular distribution often exhibits characteristic oscillations originated from an interference of two indistinguishable processes. In this seminar, I will present a novel method to visualize origins of such oscillations [1]. This is achieved by taking Fourier transform of scattering amplitudes, following the idea in wave optics. I will apply this method to elastic scattering of 16O+16O and 18O+18O at energies above the Coulomb barrier. The former system shows strong oscillations in the angular distribution due to the nearside-farside interferences, while the oscillations are largely suppressed in the latter system due to a stronger absorption. I will show that the images of the former and the latter systems correspond to a double-slit and a single-slit problems in quantum mechanics, respectively. In this way, the imaging provides an intuitive understanding of the origin and the underlying dynamics of quantum interference phenomena in nuclear reactions.

[1] K. Hagino and T. Yoda, Phys. Lett. B **848**, 138326 (2024).

This seminar is given in English.

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