筑波大学
University of Tsukuba

Condensed Matter Seminar
物性論セミナー

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14:00-15:00 Zoom

Fractal defect states in the Hofstadter butterfly

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The Hofstadter butterfly is a fractal energy spectrum of Bloch electrons in a periodic lattice under a magnetic field, and it is one of the first quantum fractals discovered in physics. After about 40 years since the theoretical prediction, the Hofstadter butterfly was experimentally realized in 2D moiré superlattices and so on. Currently, however, the experimental observation is limited to the measurement of the energy spectrum and the transport properties. Actually, richer fractal information is encoded in the Bloch wavefunctions themselves, but it has not been clarified yet.

We investigate the electronic properties of the Bloch electron on a two-dimensional lattice with a point defect under the uniform magnetic field, and establish a theoretical formalism on the rich spatial fractal information of the Hofstadter butterfly [1]. Our results provide a new quantitative perspective on the spatial fractal nature, and a powerful way to elucidate the fractality of the Hofstadter butterfly.

[1] Yoshiyuki Matsuki, Kazuki Ikeda, and Mikito Koshino, Phys. Rev. B 104, 035305 (2021)

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