量子の状態制御と機能化
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Realization of the strongly-correlated topological Haldane model in exciton-polaritons

§1. 研究成果の概要

•Specific research matter

Goal: To observe fractional quantum Hall-like phenomena in a strongly-coupled light-matter system (exciton-polaritons), and facilitate the observation of manipulable non-Abelian (Fibonacci type) anyonic particles for the creation of quantum computers and simulators robust against environmental noise.

Methodology: To create complex (real + imaginary) and topological artificial lattices for exciton-polariton condensates in a configuration relevant for the strongly correlated Haldane model, i.e. topological non-triviality via locally broken time-reversal symmetry and strong correlations via band flattening.

•Research progress and progress situation, achievements

Research items:

- Fabrication of samples exhibiting topological and non-Hermitian potentials by structured proton implantation
    - Design of new potential lattice layouts
    - Refinement of fabrication recipes
    - Optimization of material deposition and etching parameters
- Theoretical study of polariton condensate dynamics in non-Hermitian and topological lattices
- Theoretical study of dynamics of rapidly rotating, trapped polaritons and the nucleation of quantized vortex lattices
- Designing optical systems to fulfill the criteria for bosonic fractional quantum Hall effects.