

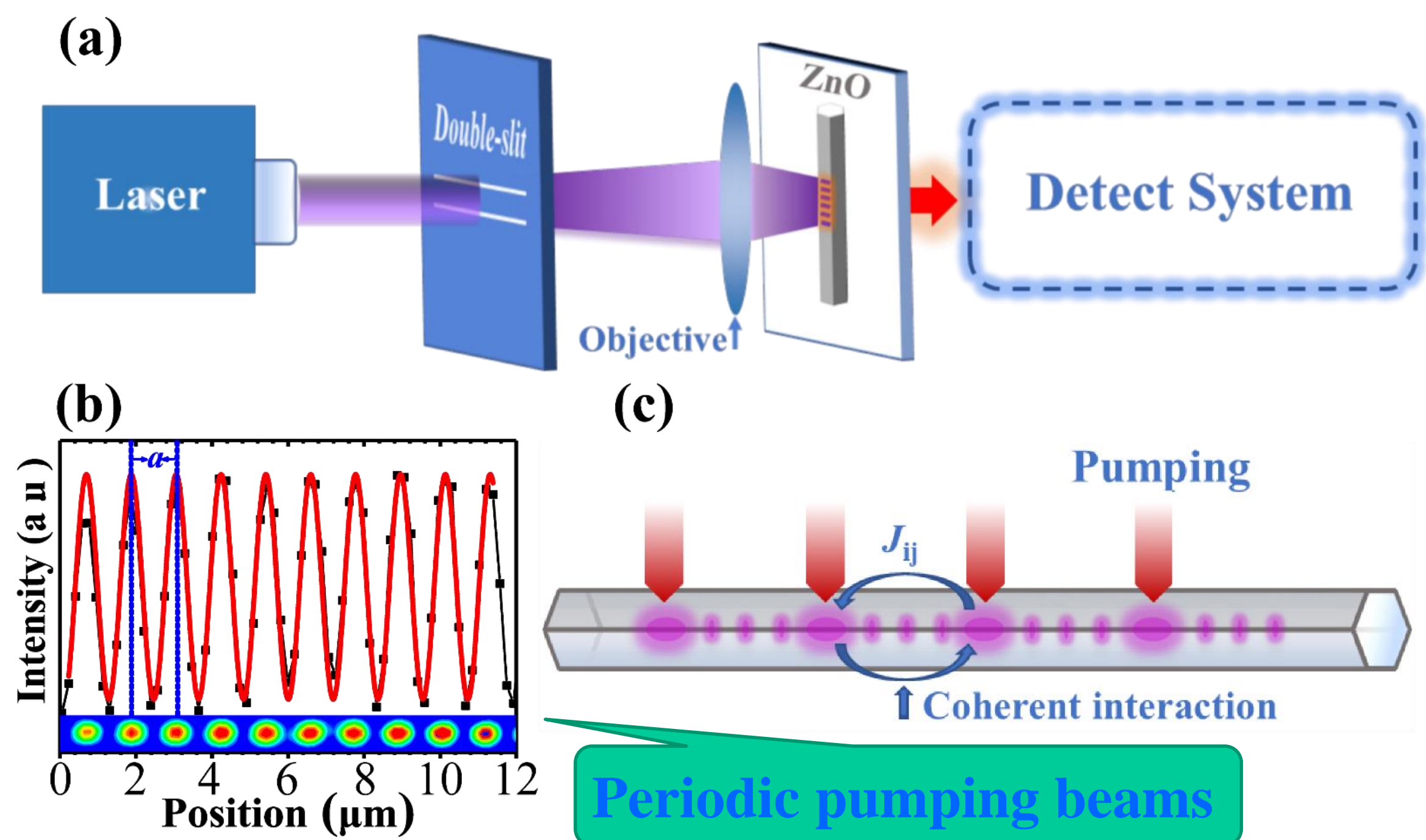
The Ising chain of room-temperature polariton condensates

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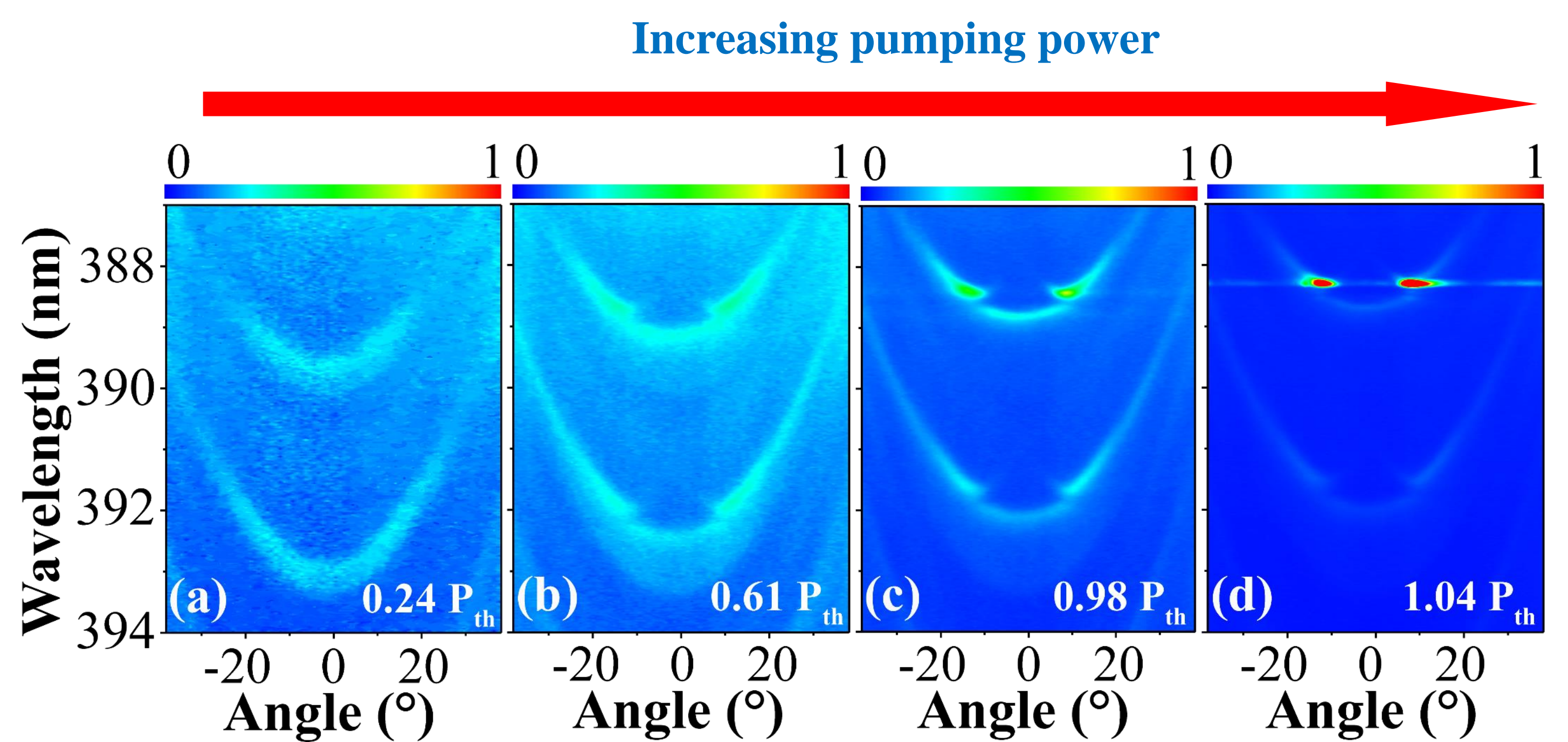
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• **Abstract:** One-dimensional (1D) lattice of exciton-polariton is created by exciting a ZnO microwire with a periodic laser spots. The condensates phase-lock to form either π or zero state depending on the chosen value of the lattice constant. The system is mapped to a 1D Ising Hamiltonian. It models the transition between ferromagnetic and antiferromagnetic phase in a spin chain. All the measurements are done at room temperature. These observations pave the way to the realization of ultrafast simulators based on the condensates of exciton-polaritons.

Experiment and Discussion

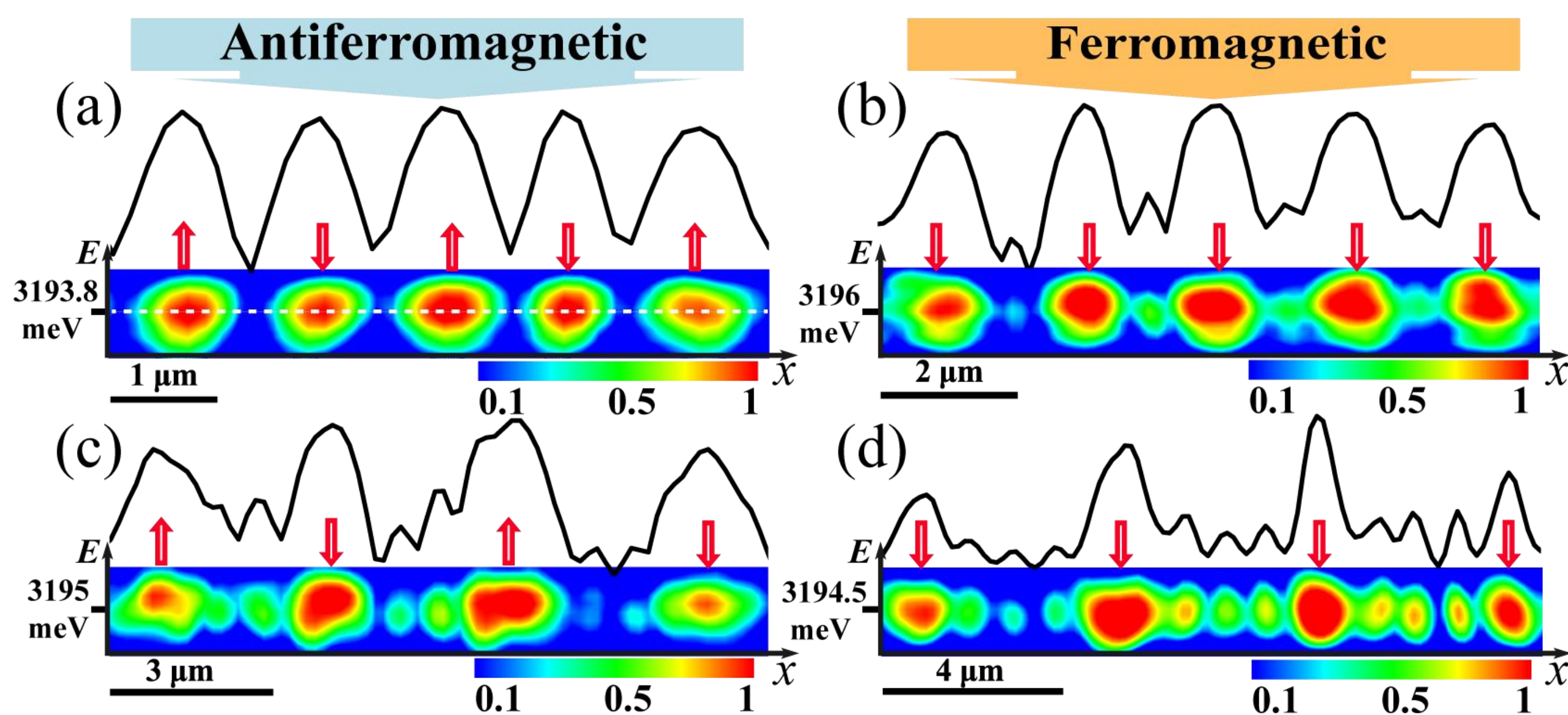


Preparation of polariton lattice

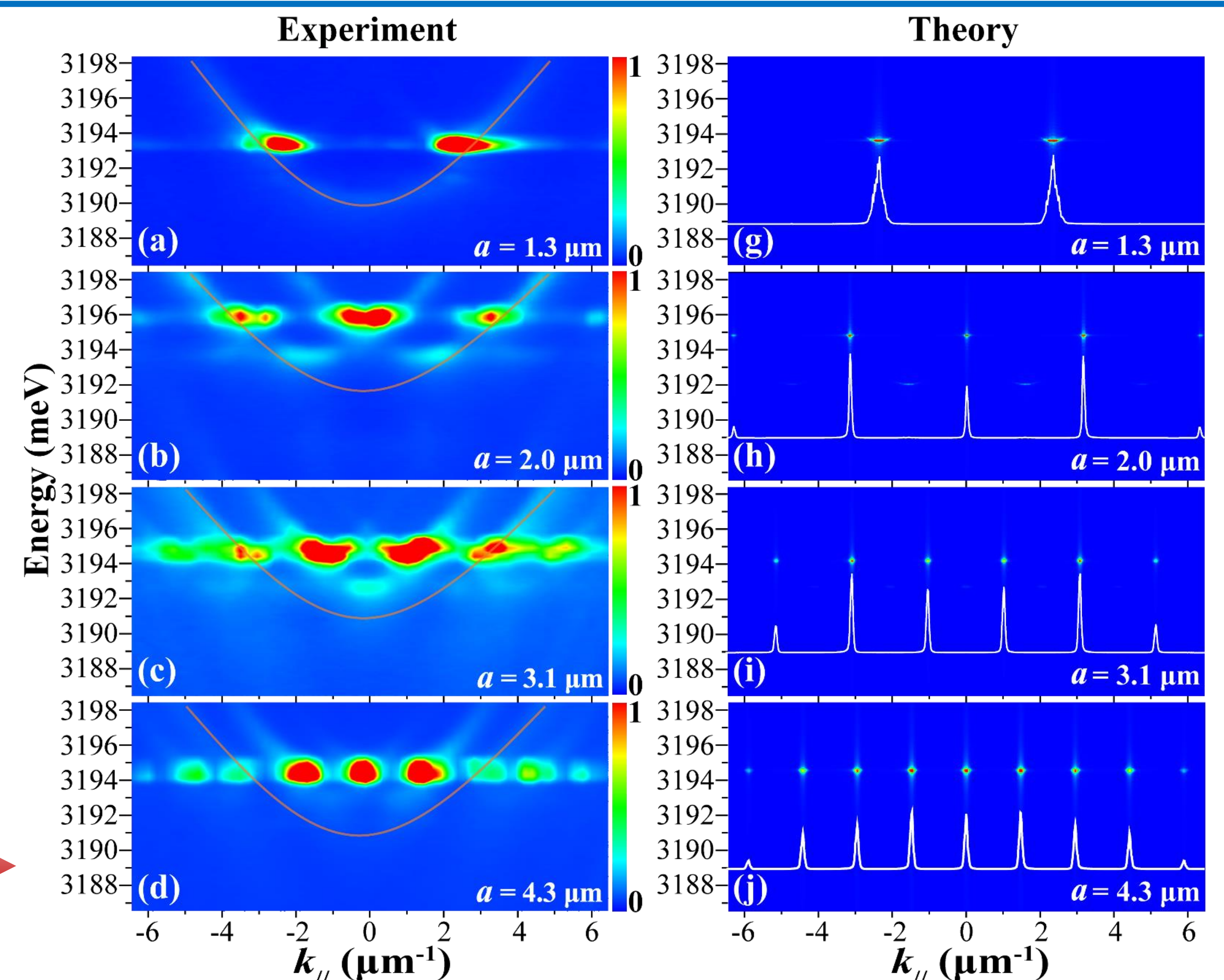


The band structure evolution of polariton lattice

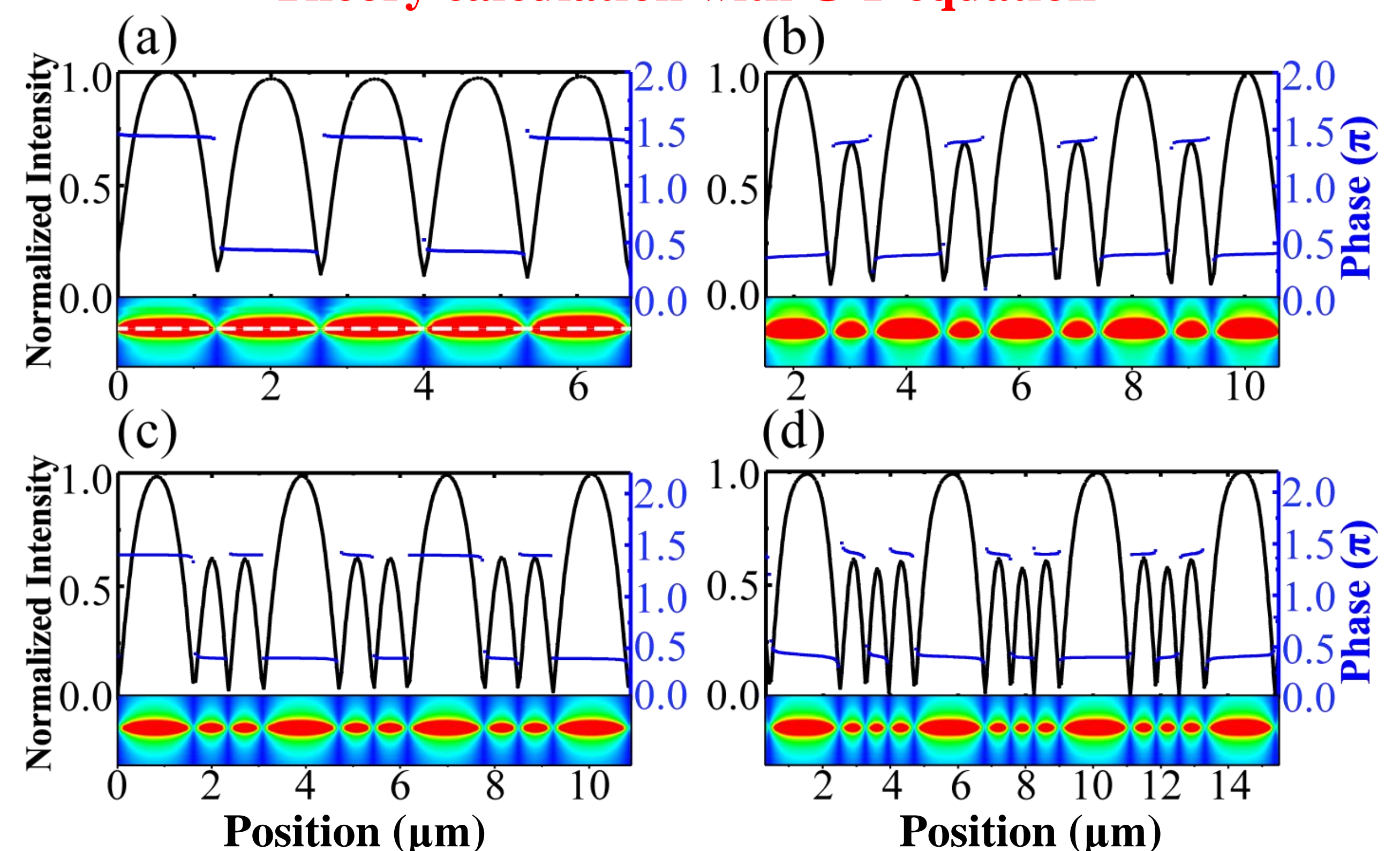
The Ising chain of polariton condensates :



Angle-resolved PL technology



Theory calculation with G-P equation



G-P Equation:

$$i\hbar \frac{\partial \psi_x}{\partial t} = \left[\frac{-\hbar^2}{2m} \nabla^2 + g_p |\psi_x|^2 + \hbar g_R N_R + V(x) \right] \psi_x + \frac{i\hbar}{2} (\eta N_R - \gamma_p) \psi_x$$

Reservoir Polaritons come from the reservoir

◆ **Spin:** the phase of polariton condensate

◆ **Spin-Spin interaction:** the phase coupling between condensates:

$$J_{ij} = \int_0^\infty |\psi_{k_x}|^2 \cos(k_x d_{ij}) dk_x$$

Polaritons condense into the minimum of Ising Hamiltonian:

$$H = -\sum_{ij} J_{ij} s_i s_j = -\sum_{ij} J_{ij} \cos(\theta_i - \theta_j)$$