

KUROYAMA LAB.

Semiconductor Quantum Nanodevice



Department of Informatics and Electronics

Quantum Nanoelectronics

Department of Electrical Engineering and Information Systems, Graduate School of Engineering

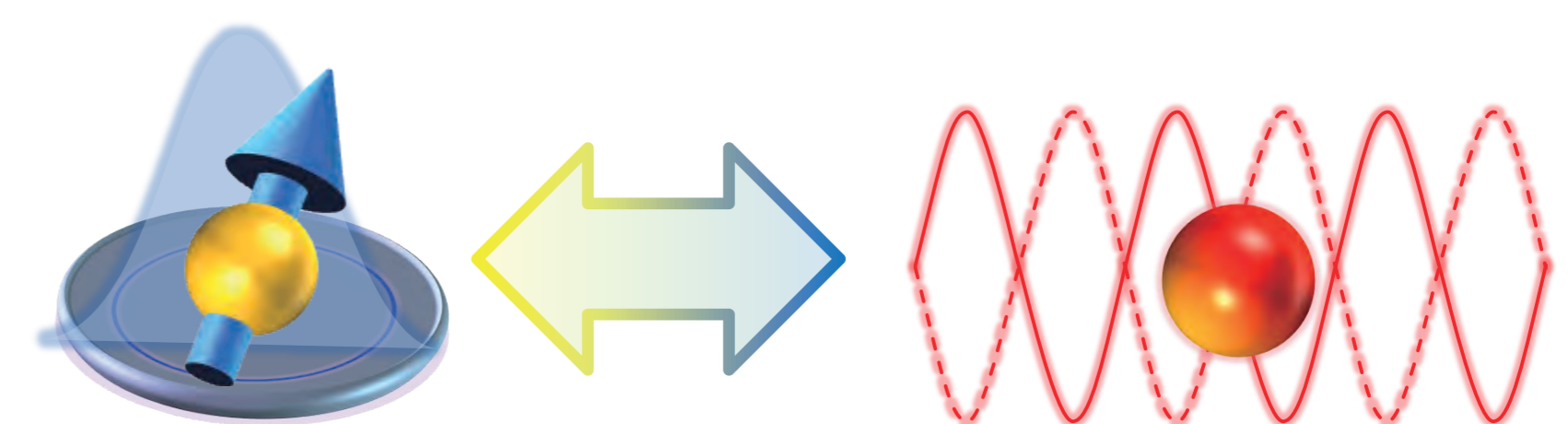
<https://www.qnel.iis.u-tokyo.ac.jp/en/>

Nanoelectronics in Quantum Light-Matter Coupled Systems

We investigate quantum phenomena of electrons in semiconductor nanostructures. Our research focuses on hybrid quantum states created by strong coupling between electrons and photons in optical cavities, with potential applications in quantum information processing and optical control of condensed-matter properties.

Charge or spin

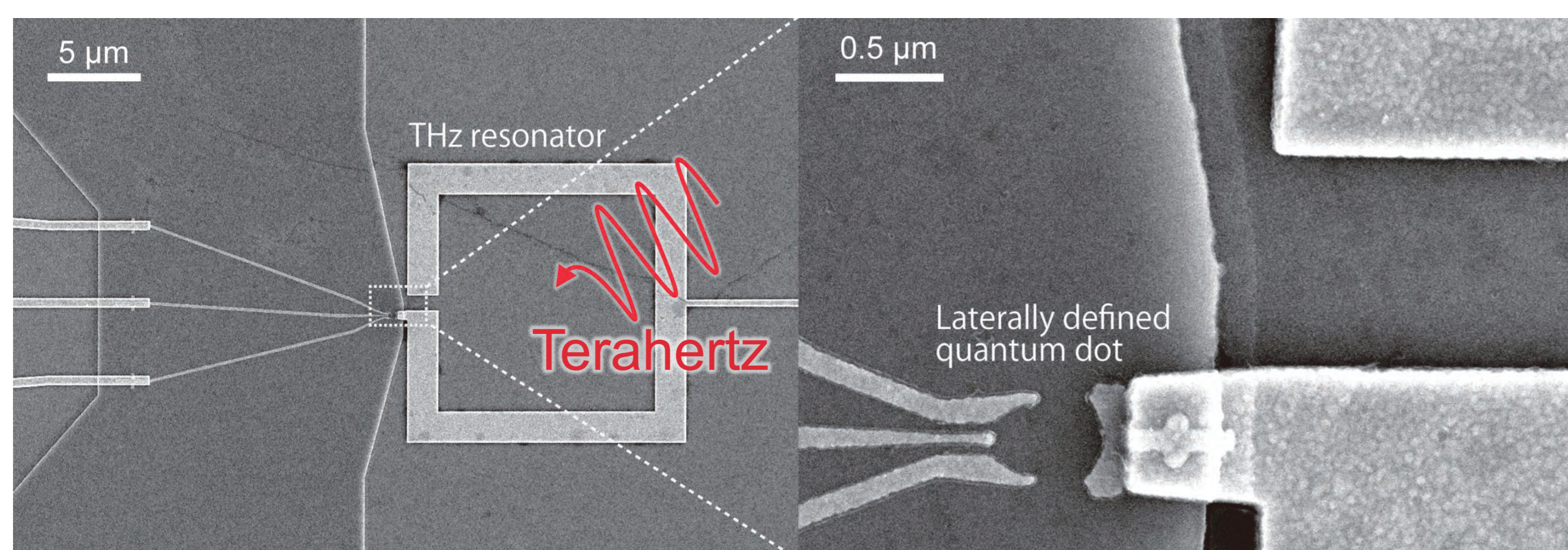
Photon



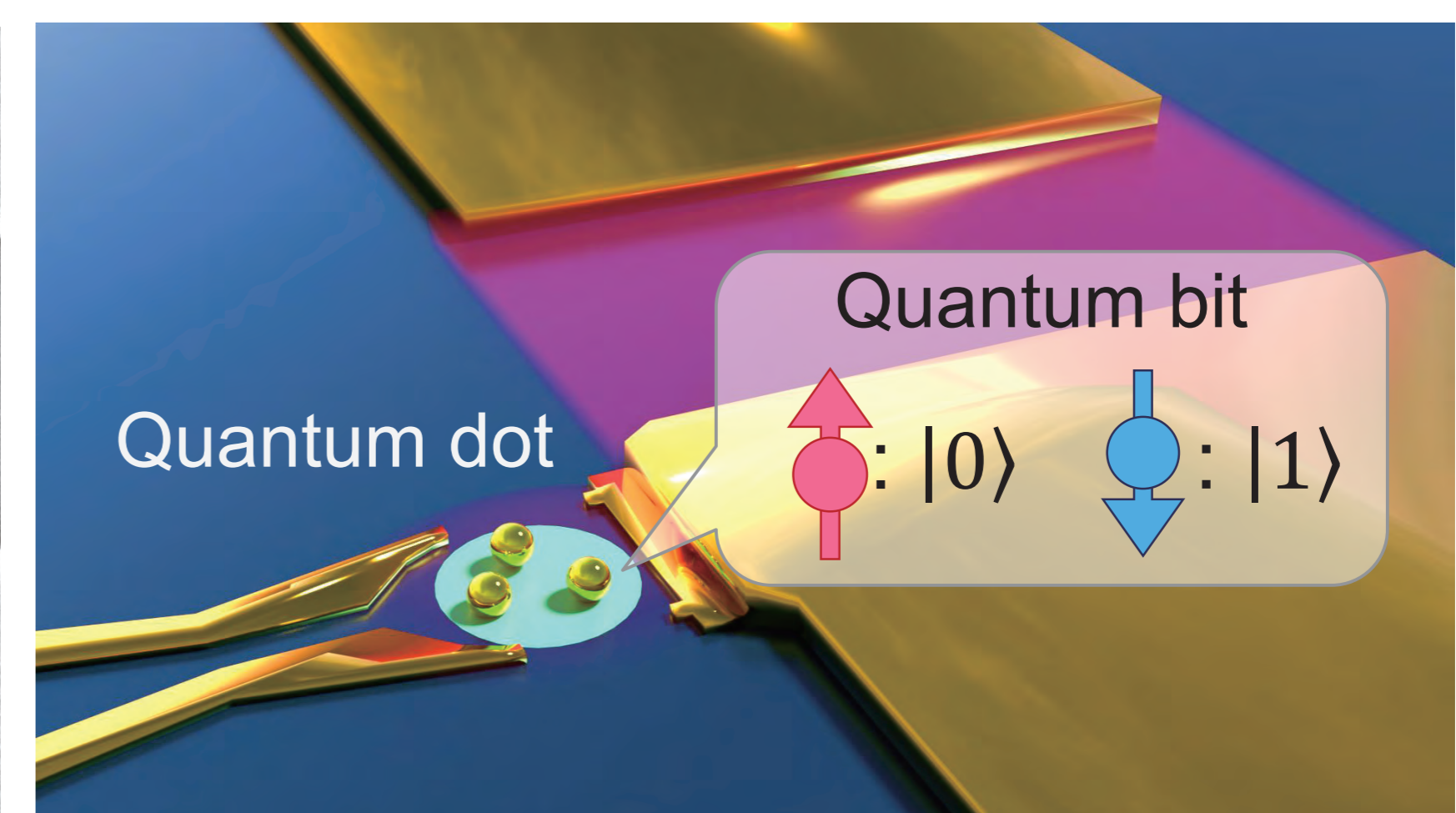
Quantum hybridization

- Quantum computing technology
- Cavity material engineering

Semiconductor Nanostructures for Quantum Information Processing Devices

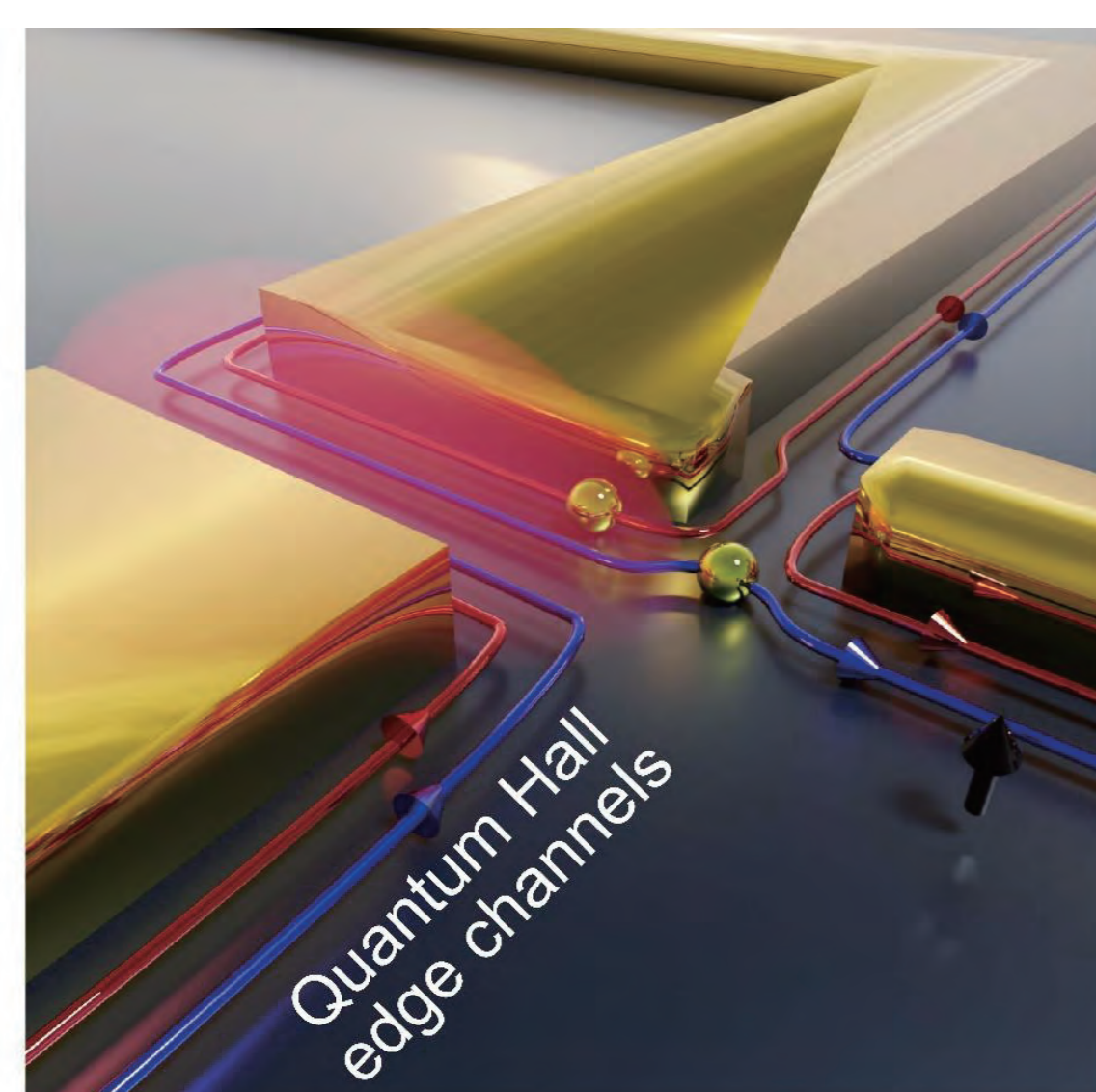


terahertz optical resonators to realize hybrid quantum states formed by strong coupling between confined electrons and terahertz photons.

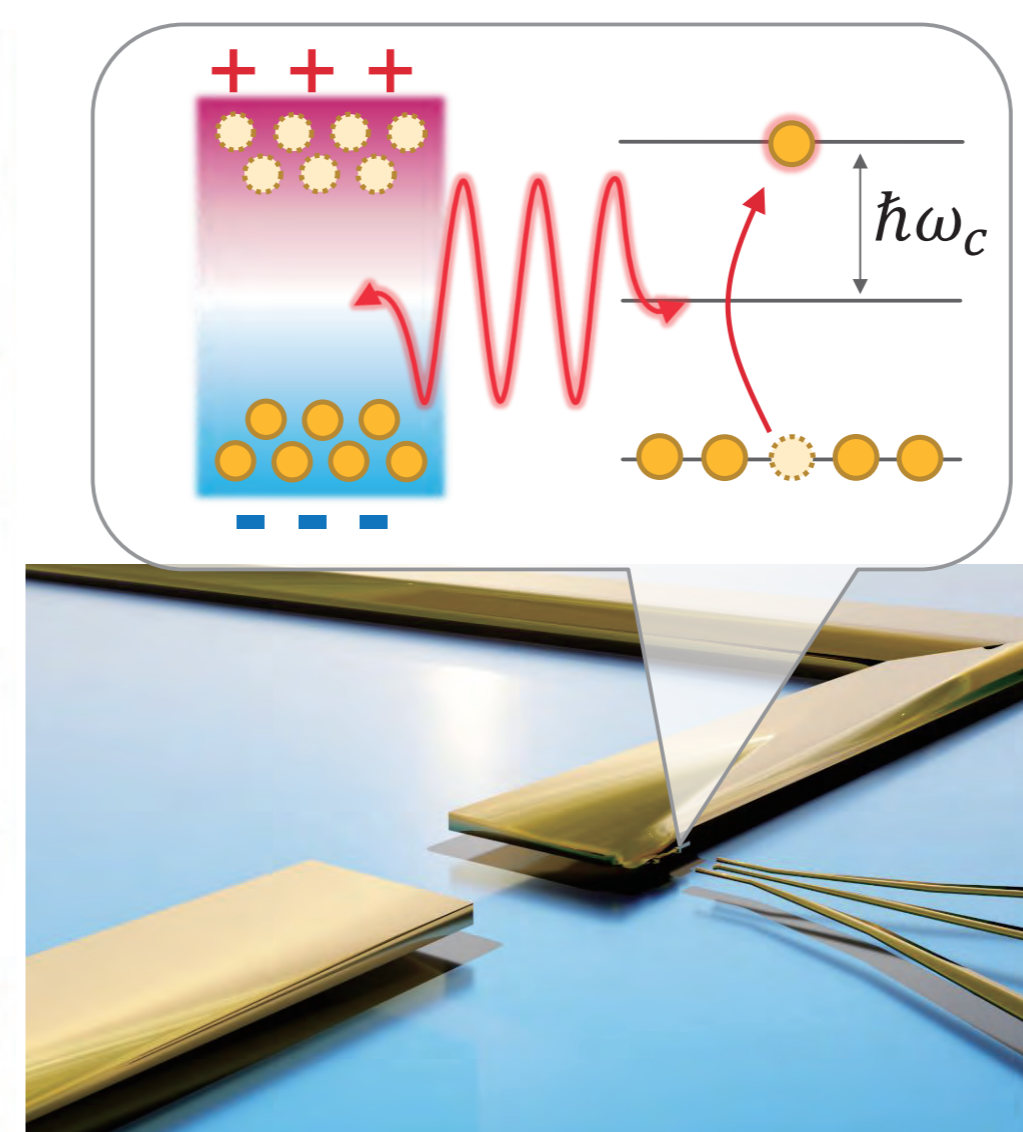
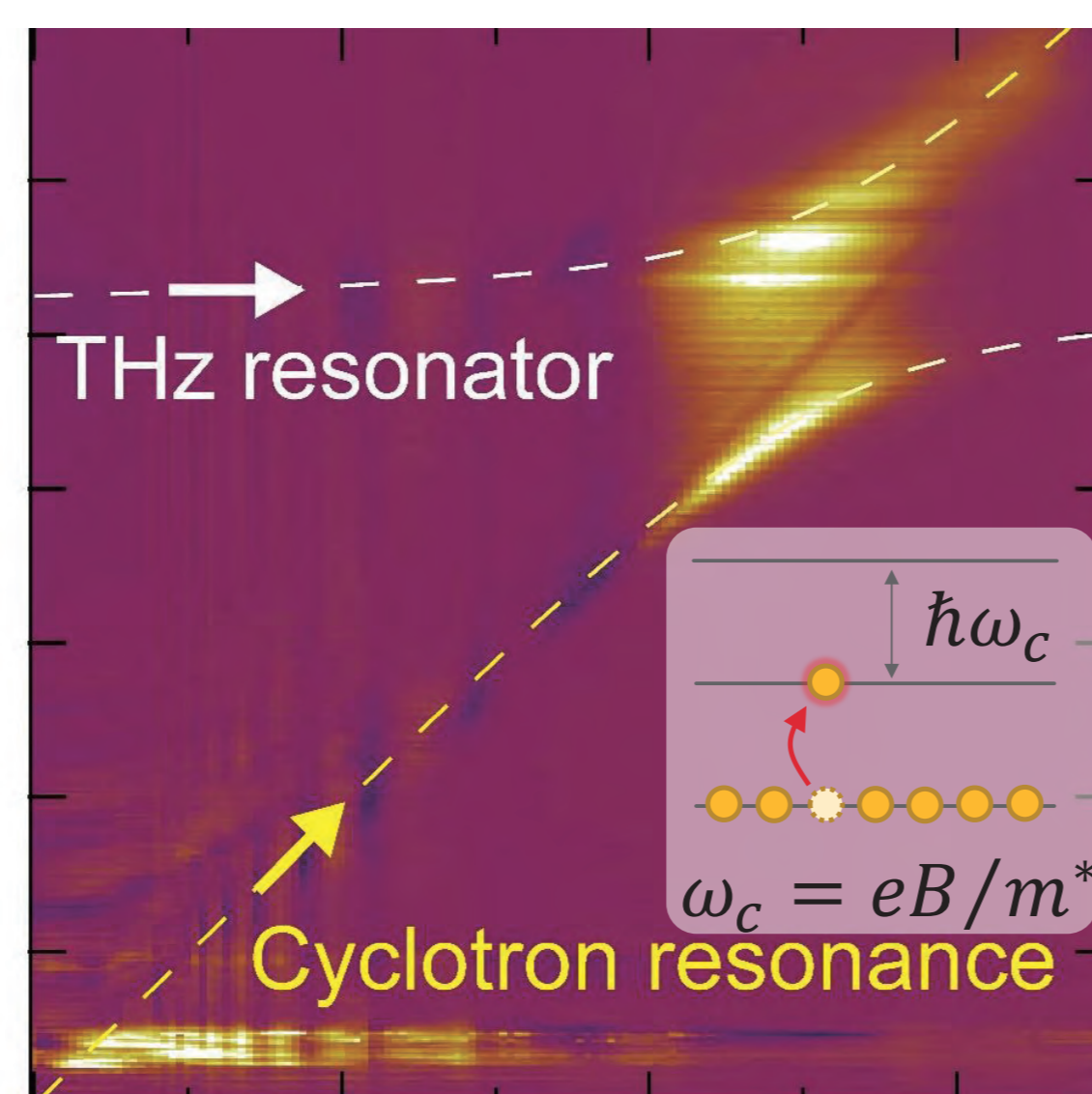


quantum dots are coupled to a terahertz optical resonator.

Extremely Strong Interaction between Light and Matter



Observation of ultrastrong coupling between quantum Hall electrons and a terahertz optical resonator.



Observation of ultrastrong coupling between collective electron excitations (plasmons) and higher-order cyclotron excitations.

