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場所：物性研究所本館 6 階 第一会議室

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題目：

Cavity QED in the Ultrastrong Coupling Regime

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Strong resonant light-matter coupling in a cavity setting is an essential ingredient in fundamental cavity quantum electrodynamics (QED) studies as well as in cavity-QED-based quantum information processing. In particular, a variety of solid-state cavity QED systems have recently been examined, not only for the purpose of developing scalable quantum technologies, but also for exploring novel many-body effects inherent to condensed matter. This talk will first describe our recent observation of collective ultrastrong light-matter coupling in a 2D electron gas in a high-quality-factor terahertz cavity in a quantizing magnetic field, demonstrating a record-high cooperativity [1]. The electron cyclotron resonance peak exhibited splitting into the lower and upper polariton branches with a magnitude that is proportional to the square-root of the electron density, a hallmark of collective vacuum Rabi splitting. The second part of this talk will present 1D microcavity-exciton-polaritons in a thin film of aligned carbon nanotubes [2] embedded in a Fabry-Perot cavity, also exhibiting collective ultrastrong light-matter coupling. These experiments open up a variety of new possibilities to combine the traditional disciplines of many-body condensed matter physics and cavity-based quantum optics.

References

1. Q. Zhang *et al.*, *Nature Physics* **12**, 1005 (2016).
2. X. He *et al.*, *Nature Nanotechnology* **11**, 633 (2016).

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