物質・情報卓越教育課程
Academy for Convergence of Materials and Informatics

Institute of SCIENCE TOKYO

2.5次元物質科学：
社会変革に向けた物質科学のパラダイムシフト

Special Lecture

Excitons in Atomically Thin Two-Dimensional Semiconductors and Moiré Structures

2025年6月3日（火）15:30〜

東京科学大学 大岡山キャンパス 本館2階290室 および Zoom

事前登録不要
直接会場にお越しください

Zoom での参加はこちら ▷▷▷

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Abstract:

Two-dimensional van der Waals materials exhibit novel photoexcited states, intriguing field-driven and time-dependent phenomena, and exotic ground states. Here, we present some recent theoretical advances in their understanding and predictions. Our studies reveal a rich diversity of excitons in transition metal dichalcogenide (TMD) moiré superlattices, including previously unforeseen intralayer charge-transfer moiré excitons. We have also discovered a self-driven exciton-Floquet effect in the time-resolved, angle-resolved photoemission spectroscopy of 2D materials, where exciton-induced satellite features and band renormalization emerge, analogous to the optical Floquet effect driven by photons. We further show that strong excitonic physics in 2D semiconductors can greatly enhance their nonlinear optical responses, such as shift currents and second- or higher-order harmonic generation. This has led to a remarkable phenomenon – the formation of light-induced shift current vortex crystals in TMD moiré systems. Finally, we predict that in certain intrinsic TMD 2D materials, spontaneously formed excitons condense into an unconventional excitonic insulator phase, characterized by emergent k-space spin textures and other telltale spectroscopic signatures.

共催：東京科学大学 物質・情報卓越教育課程 ／ 物質・情報卓越コース
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