2023 IBS-CALDES Seminar

- ✓ **Date & Time** 3:00PM, September 21 (Thu), 2023
- ✓ **Venue: Room** #105 (Conference Room), IBS POSTECH campus bldg.
- ✓ **Speaker & Title**

3:00PM~ Prof. Myungchul Oh (POSTECH)

"Scanning Probe Microscopy on Correlated Phases in Twisted Moiré Materials"

Organized by: Dr. Ungdon HAM (uham@ibs.re.kr, 054-260-9015)

- **3:00PM~**

Scanning Probe Microscopy on Correlated Phases in Twisted Moiré Materials

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In a flat band system, interactions between electrons become dominent due to the suppressed kinetic energy and many-body effect begins to occur. The recent breakthrough in engineering the band structure by creating a moiré superlattice in a twisted two-dimensional system has paved the way for the exploration of numerous strongly correlated quantum phenomena that emerge from the symmetry broken many-body ground state, such as correlated insulators, non-trivial topological phases, and unconventional superconductors [1-3].
In this talk, I will discuss the moiré superlattice flat band engineering in twisted two-dimensional van der Waals heterostructure and the correlated phases in the moiré superlattice systems, and describe underlying many-body physics in those phases.
I will also highlight the novel scanning tunneling microscopy technique that has enhanced our understanding of the microscopic electronic structures of their ground states [1,3,4], describing details of the technical intricacies of the advanced STM instrumentation which facilitates the exploration of two-dimensional quantum material devices.

keywords : many-body physics, correlated phases, twisted materials, STM

References

[1] Wong, D.*, Nuckolls, K. P.*, Oh, M.*, Lian, B.*, Xie, Y., Jeon, S., Watanabe, K., Taniguchi, T., Bernevig, B. A. & Yazdani, A. Cascade of electronic transitions in magic-angle twisted bilayer graphene. Nature 582, 198–202 (2020).
[2] Nuckolls, K. P.*, Oh, M.*, Wong, D.*, Lian, B.*, Watanabe, K., Taniguchi, T., Bernevig, B. A. & Yazdani, A. Strongly correlated Chern insulators in magic-angle twisted bilayer graphene. Nature 588, 610–615 (2020).
[3] Oh, M.*, Nuckolls, K. P.*, Wong, D.*, Lee, R. L., Liu, X., Watanabe, K., Taniguchi, T. & Yazdani, A. Evidence for unconventional superconductivity in twisted bilayer graphene. Nature 600, 240–245 (2021)
[4] Nuckolls, K. P.*, Lee, R. L.*, Oh, M.*, Wong, D.*, Soejima T.*, Hong, J. P., Călugăru, D., Arbeitman, J. H., Bernevig, B. A., Watanabe, K., Taniguchi, T., Regnault, N., Zaletel M. P. , Yazdani, A. Nature 620, 525-532 (2023)
[5] Wong, D.*, Jeon, S.*, Nuckolls, K.P.*, Oh, M.*, Kingsley, S., Yazdani, A. Rev. Sci. Instrum. 91, 023703 (2020)
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