

The rich world of van der Waals heterostructures: from quantum spin liquids to heavy fermions

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The controlled stacking, twisting, and straining of two-dimensional van der Waals materials has opened new avenues for realizing correlated and topological quantum phases. In such heterostructures, interactions between layers can give rise to emergent behavior not present in the individual constituents, including correlated metals, unconventional magnetism, and topological superconductivity. In this talk, I will outline theoretical approaches for modeling these systems from first principles and highlight representative examples that demonstrate the richness of their electronic and magnetic properties [1-7], with connections to recent experimental findings.

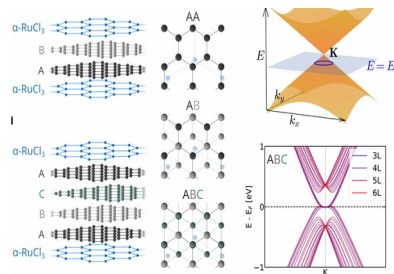


Figure 1: α -RuCl₃-graphite heterostructure (from [2])

- [1] Souza *et al.* [arXiv:2605.22522]
- [2] Razpopov *et al.* [arXiv:2512.03147]
- [3] Bae *et al.* npj Quantum Mater. **10**, 92 (2025)
- [3] Crippa *et al.* Nature Communications **15** (1), 1357 (2024)
- [4] Akram *et al.* Nano Letters **24**, 890 (2024)
- [5] Rai *et al.* PRX **14**, 031045 (2024)
- [6] Kim *et al.* Nature **623**, 942 (2026)