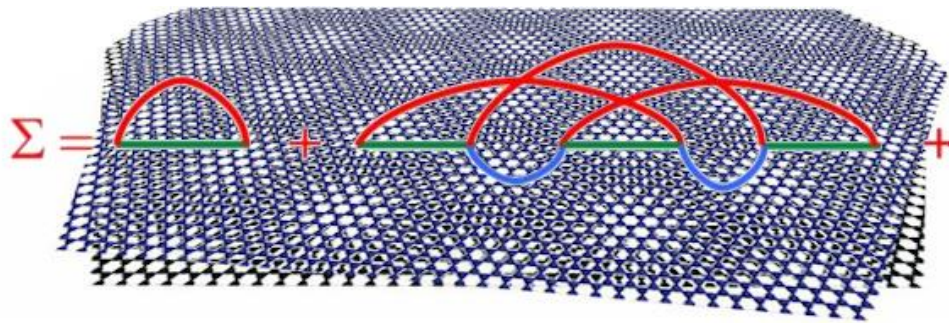


# PhD Opening: Unravelling Strong Correlations in Twisted 2D Multilayers

Supervisor: Dr Gunnar Möller, Physics of Quantum Materials Group, University of Kent



**We seek** candidates for PhD position with an interest in numerical simulations of strongly correlated matter. The successful candidate will work with Dr Gunnar Möller in the Physics of Quantum Materials Group at the University of Kent. Candidates who are selected for this [EPSRC-funded studentship](#) will receive a full stipend and university for a duration of 3.5 years, and will enjoy access to departmental research funds to further their training and dissemination of their research. The post is open for applications from UK (home) and overseas (international) students.

**The project** will focus on twisted graphene multilayers that have been heralded for the discovery of new types of correlated insulators [1] and superconducting phases [2], triggering a wave of excitement about these spectacular new regimes of strong correlation physics. A small twist between two stacked graphene layers leads to huge ‘moiré’ unit cells with 1000s of atoms, but only few degrees of freedom are relevant at low energies and reduce to a low-energy manifold of eight flat bands near the magic twist angle. There has been much work on this system, but a definite quantitative understanding of these interacting regimes in multiband materials remains lacking.

To unravel strong correlation physics in multiband models such as these, the idea for this project is to generalise the connected determinantal Monte-Carlo (cDet) approach [3]. The cDet algorithm has already yielded definite answers in many difficult to understand regimes for the case of the single band Hubbard model [4].

During this project, we will first benchmark the approach on simple limiting cases and will then proceed to more realistic two-band models. Ultimately, we will study advanced applications to multi-band models of twisted graphene multilayers. The work will extend an established code-base for diagrammatic Monte-Carlo algorithms developed in Dr Möller’s group, and will benefit from established national and international collaborations.

**For further information**, see <https://bit.ly/cDet-Multiband>

**To apply** for this funded PhD opportunity students should follow the [University of Kent’s online postgraduate application process](#), providing the following supporting information:

- Identify the project and supervisor that you would like to work with
- Explain your motivation for PhD study and provide any relevant information demonstrating your qualification for conducting your chosen project
- Provide details/evidence of qualifications, including two academic references

## **Bibliography:**

- [1] Y.Cao, *et al.*, [Nature 556, 80–84 \(2018\)](#). [2] Y.Cao, *et al.*, [Nature 556, 43–50 \(2018\)](#).  
[3] R.Rossi, [Phys. Rev. Lett. 119, 045701 \(2017\)](#).  
[4] Fedor Šimkovic, *et al.* [Phys. Rev. Lett. 124, 017003 \(2020\)](#).

