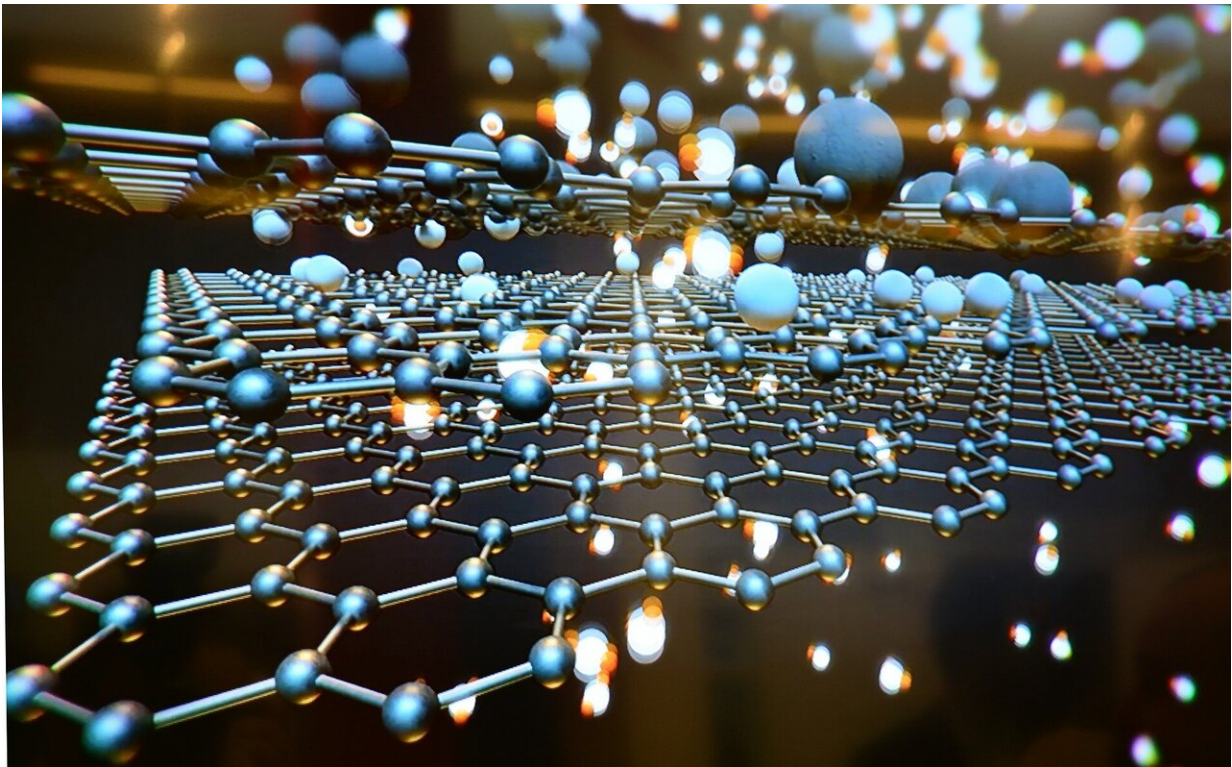


# Bringing consistency to methods of 2D material analysis

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In materials science, the term "2D materials" refers to crystalline solids that consist of a single layer of atoms, with arguably the most famous example being graphene — a material made of a single layer of carbon atoms. These materials are promising for a wide range of applications

including in sophisticated electronics and quantum computing thanks to their unique quantum properties.

One of the most promising methods of investigating these materials, and specifically their temperature instabilities, and for investigating quantum many-body phenomena is the functional renormalization group (FRG). Yet, despite significant efforts, no systematic and comprehensive cohesion exists for different momentum space FRG implementations.

A new paper published in *EPJ B* and authored by Jacob Beyer, Institute for Theoretical Solid State Physics, RWTH Aachen University, Germany, alongside Jonas B. Hauck, and Lennart Klebl of the university's Institute for Theory of Statistical Physics lays out a potential groundwork for achieving consistency across FRG methods.

To do this, the team analyzed three different independently developed FRG codes and achieved an unprecedented level of conformity between these implementations. They also lay out an exact procedure that can be followed by other researchers to achieve a similar analysis.

The authors of the paper point out that though a lack of cohesion in this area has not prevented the publication of relevant scientific results, however an established mutual agreement across FRG realizations will strengthen confidence in the method.

Seeing this as a first step towards a shared knowledge repository and motivated by potential application to strongly correlated states in two-dimensional [materials](#), the researchers substantiated the reproducibility of their calculations by scrutinizing pillar FRG results reported in the literature.

This allowed the team to verify the implementation of their method against established results for momentum space FRG calculations.

The team is currently working to combine their codes under a single, versatile "community code" with a polished, common, easy-to-use interface that will be available to all FRG researchers and for others interested in investigating many-body problems in physics.

**More information:** Jacob Beyer et al, Reference results for the momentum space functional renormalization group, *The European Physical Journal B* (2022). [DOI: 10.1140/epjb/s10051-022-00323-y](https://doi.org/10.1140/epjb/s10051-022-00323-y)

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