THE PHYSICS COLLOQUIUM

Thursday 28 May 2026, 4:00 p.m.
Nijenborgh 4, Lecture Hall **5111.0080**

Why knowing the Oktoberfest, Tesafilm and a pencil is all you need to understand unexpected quantum phenomena in graphene

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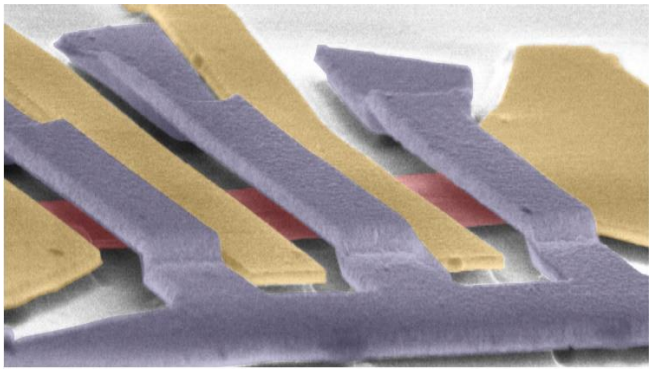
One exciting endeavor of condensed matter research is to understand how electrons in a solid interact with one another and the underlying atoms. Depending on this intricate interplay, the system can have drastically different properties, for example be either insulating or superconducting. Due to the many electrons and atoms involved, one can image that developing a general understanding of this interplay is very complex. In this sense, finding experimental systems that allow systematically control of e.g. charge carrier density and/ or their mutual interaction is highly desirable. The novel class of van-der-Waals materials offers such tunability. This talk will give a general introduction in the fascinating class of van-der-Waals materials, how to prepare them and why these quantum materials are of interest for fundamental sciences but also potential applications in fields as diverse as quantum computation and energy science. One specific material will be discussed in greater detail, so-called naturally occurring Bernal bilayer graphene. This is a material that is just two carbon atoms thick. It is a truly fascinating system where we can control whether electrons behave more as individuals or strongly interact. Specifically, I will show how we systematically identify and explore such phases by controlling not only the density of states, the charge carrier density but also the interaction between charge carriers. Most intriguingly we identified anomalous quantum Hall and Wigner crystal phases in bilayer graphene. Last but not least, the talk will give a brief look into our laboratory, our work beyond graphene, why we have a little Oktoberfest on a daily basis and why Tesafilm and pencils are important tools for our research.



Artificially colored scanning-electron microscopy image of freestanding two-atom thin carbon layer (bilayer graphene, red) with metal electrodes which allows to analyze electronic phases at cryogenic temperatures. (F.R. Geisenhof et al. Nature 598, 53-58 (2021)

Join us for coffee starting 3:30 p.m. Refreshments will be served after the lecture.
For more information contact the hosts: Marco Guimaraes (m.h.guimaraes@rug.nl)
Website: https://www.rug.nl/research/fse/colloquia/physics-colloquia