



Walther-Meißner-Seminar

Walther-Meißner-Institute, Seminar Room 143

Date: Friday, 12 January 2024, 11:15 h

Speaker: Prof. Bart van Wees

*Zernike Institute for Advanced Materials, University of Groningen,
Groningen, The Netherlands*

Title: Spin waves and magnons in two-dimensions: Emergent physics and new applications

Abstract:

Spintronics addresses the research on, and applications of, the transport, control and manipulation of the angular momentum of electrons, their “spin”. Spin currents are usually carried by mobile electrons, in both magnetic and nonmagnetic metals and semiconductors. In contrast, spin waves (magnons) are propagating wave like excitations of the magnetic order in ferro and antiferromagnetic materials. In recent years these have been shown as very effective carriers of spin current and spin information, even in electrically insulating materials [1][2].

In this talk I will give an introduction of spintronics in two-dimensional Van der Waals materials (including graphene), their heterostructures and devices. I will then show that spin currents can also be carried by spin waves in two-dimensional ferromagnetic and antiferromagnetic materials, and explain how their different (anti) ferromagnetic properties are reflected in the magnon spectrum and magnon transport [3]. I will conclude with an outlook of new devices and applications which will become possible by the combination of two-dimensional materials and their heterostructures with (spin wave) spintronics.

References

- [1] Long-distance transport of magnon spin information in a magnetic insulator at room temperature, L.J. Cornelissen, et al., *Nature Physics* **11** (12) (2015).
- [2] Giant magnon spin conductivity in ultrathin yttrium iron garnet films, X.Y. Wei, et al., *Nature Materials* **21** (12) (2022).
- [3] Long-distance magnon transport in the van der Waals antiferromagnet CrPS₄, D.K. de Wal, et al., *Phys Rev. B* **107** (18) (2023).