


**Physikalisches Kolloquium**  
Einladung**Physics Colloquium**  
Invitation**Monday, 29 April 2024****BE AWARE - ROOM CHANGE** - Lecture Hall **O25/H2**, at 16:15  
Coffee and cookies will be served in front of the lecture hall from 16:00**Universal matter-wave interferometry across the  
mass & complexity scales****Prof. Dr. Markus Arndt**

University of Vienna, Faculty of Physics, Austria

 <https://ufind.univie.ac.at/de/person.html?id=22139;>  
<https://www.quantumnano.at/>

We celebrate the centenary of Louis de Broglie conception of matter waves. It inspired Erwin Schrödinger's wave equation and a century of studies on quantum foundations and technologies. Louis de Broglie still believed to have solved "probably ... all problems related to quanta" [1], however, the very nature of the quantum wave has remained a matter of debate.

Our research group at the University of Vienna is running matter-wave interference experiments with atoms [2], hydrocarbons [3], organic clusters [4], biomolecules [5-8] and macromolecules [8] in more than half a dozen of different matter-wave interferometers, searching for indications of violations of quantum linearity as well as applications in biophysical chemistry. In all experiments, quantum mechanics has been found to be the correct description of nature.

I will review these efforts and recent progress in matter-wave interferometry with nanoparticles – focusing on objects of high mass and new materials [10,11].

- [1] L. De Broglie, *Nature* **112** 540-540 (1923).
- [2] Y. Y. Fein, et al., *Phys. Rev. X* **10** 011014 (2020).
- [3] Y. Y. Fein, et al., *Phys. Rev. Lett.* **129** 123001 (2022).
- [4] P. Haslinger, et al., *Nature Physics* **9** 144 (2013).
- [5] L. Mairhofer, et al., *Angew. Chem. Int. Ed.* **56**, 10947 (2017).
- [6] C. Brand, et al., *Ann. Phys.* **527**, 580 (2015).
- [7] C. Brand, et al., *Phys. Rev. Lett.* **125**, 033604 (2020).
- [8] A. Shayeghi, et al., *Nat. Commun.* **11**, 1447 (2020).
- [9] Y. Y. Fein, et al., *Nature Phys.* **15**, 1242 (2019).
- [10] S. Pedalino, et al., *Phys. Rev. A* **106**, 023312 (2022).
- [11] F. Kiałka, et al., *AVS Quant. Sci.* **4**, 020502 (2022).

