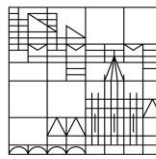


Physikalisches Kolloquium

Universität
Konstanz



Prof. Markus Oberthaler
Kirchhoff-Institut für Physik
Universität Heidelberg

Application of Quantum Technology in Environmental Physics and Cosmology

The fundamental research of controlled atomic quantum systems has become mature and applications especially in the realm of sensing and quantum simulation have been developed. I will discuss the basic tools and techniques in the field of quantum atom optics which allow for the detection of single atoms as well as simulation of relativistic quantum fields.

In the context of environmental science, the capability of detecting single atoms allows for trace analysis at the ultimate quantum level. With that opening a new door for extracting valuable information about dynamics in the environment by detecting the very rare isotope ^{39}Ar - a perfect age tracer for oceanography, ground water and ice. What kind of hurdles had to be taken and how the quantum optical side of the methods works will be discussed in detail. Case studies in oceanography and glacier ice will be presented revealing that this new method is now ready for broad applications [1]. In the talk I will also give a glimpse how quantum technology allow the study of cosmologically inspired questions, namely wave packet propagation in curved space time as well as particle production in expanding space time [2] [3].

[1] Spurensuche in der Umwelt, M. Oberthaler and W. Aeschbach, Physik Journal, 2021, Vol. 11, 25-30.

[2] Quantum field simulator for dynamics in curved spacetime, C. Viermann, M. Sparn, N. Liebster, M. Hans, E. Kath, Á. Parra-López, M. Tolosa-Simeón, N. Sánchez-Kuntz, T. Haas, H. Strobel, S. Floerchinger, and M.K. Oberthaler, Nature, 2022, Vol. 611, 260-264.

[3] Der frühe Kosmos im Labor, C. Viermann, Spektrum der Wissenschaft, Juni 2023.

Di 14.11.23

15:15 Uhr

P 603

im Anschluss Getränke und Snacks

Host:

Dr. Hagner

Organisation:

Prof. Bechinger