



CRC 1227
Designed Quantum States of Matter



GASTVORTRAG

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Leibniz Universität Hannover
Welfengarten 1, 30167 Hannover
Hauptgebäude (1101),
Seminarraum am Institut für Quantenoptik
Raum D326

Vortragender: Prof. Dr. Francesco S. Cataliotti,
LENS und Universität Florenz
(Guest of Prof. Dr. Ernst Rasel)

Thema: Quantum Control on an Atom Chip

We produce a Bose-Einstein condensate of 87Rb with an Atom-Chip. The Atom-Chip is also equipped with RF sources for coherent transfer of atoms between internal states in order to realize an atom interferometer [1].

We demonstrate a novel scheme for the tomographic reconstruction of atomic states that combines the inherent stability of the atom chip setup with the flexibility of optimization schemes [2]. This scheme allowed confirming of the superb control on parameters allowed by the experimental set-up and put it to use on improved control algorithms to realise arbitrary superposition states [3]. In the same set-up we can further control the available Hilbert space for quantum evolution exploiting Quantum Zeno dynamics [4]. Finally we show a possible route for controlling the coupling to an environment by experimentally demonstrating the stochastic Quantum Zeno effect; i.e. we prove an ergodicity relation between the survival probabilities of different stochastic series that respectively correspond to time and ensemble averages [5].

These experiments prove that Atom Chips can be ideal tools for the control of quantum dynamics opening a new way to realizing novel quantum logical gates.

References

- [1] J. Petrovic, et al., New J. Phys. 15 (4), 043002 (2013)
- [2] C. Lovecchio, et al., New J. Phys. 17, 093024, (2015)
- [3] C. Lovecchio, et al., Phys. Rev. A 93, 010304(R) (2016)
- [4] F. Schaefer, et al., Nature Communications 5:3194 (2014)
- [5] S. Gherardini, et al., Quantum Sci. Technol. 2, 015007 (2017)

**Zu dieser Veranstaltung sind alle DQ-mat-Mitglieder und
alle Interessierten herzlich eingeladen.**