



CRC 1227  
Designed Quantum States of Matter



## GUEST LECTURE

**Mag. Dr. Marcus Huber**

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(Guest of Prof. P. Schmidt and Prof. K. Hammerer)

Leibniz Universität Hannover

DQ-mat Colloquium

**14 July 2022, 3.00 pm**

**(Room D326, Welfengarten 1)**

### **"High-dimensional entanglement for quantum communication"**

Entanglement unlocks many applications in quantum communication, such as the highest possible level of security in quantum key distribution. As photons are inevitably lost or decohered over longer distances, it seems obvious that using the full spectrum of photonic degrees of freedom is desirable. In addition to more encodable bits per photon, entanglement in high dimensions also yields a surprising resistance to noise [1]. This comes at the expense of more complicated measurements that in themselves can contribute to the overall noise in the data, leading to an interesting optimisation. While random, noisy entanglement may not always be useful or need unrealistic control to be harnessed, I will also present a protocol that can be used in high-dimensional systems, even with restricted measurement possibilities [2], which has recently been successfully employed in path [3] and energy-time [4] experiments.

[1] S. Ecker, F. Bouchard, L. Bulla, F. Brandt, O. Kohout, F. Steinlechner, R. Fickler, M. Malik, Y. Guryanova, R. Ursin, M. Huber, Phys. Rev. X 9, 041042 (2019)

[2] M. Doda, M. Huber, G. Murta, M. Pivoluska, M. Plesch, Ch. Vlachou, Phys. Rev. Applied 15, 034003, (2021)

[3] X. Hu, C. Zhang, Y. Guo, F. Wang, W. Xing, C. Huang, B. Liu, Y. Huang, C. Li, G. Guo, X. Gao, M. Pivoluska, M. Huber, Phys. Rev. Lett. 127, 110505 (2021)

[4] L. Bulla, M. Pivoluska, K. Hjorth, O. Kohout, J. Lang, S. Ecker, S. Neumann, J. Bittermann, R. Kindler, M. Huber, M. Bohmann, R. Ursin, arXiv:2204.07536

**All DQ-mat members and all interested are cordially invited to attend.**