

**SONDERSEMINAR/SPECIAL SEMINAR**  
**MPQ/LMU**

**Date:** Tuesday, June 26, 2018

**Time:** 10:00 a.m., s.t.

**Presentation:** Timon EICHHORN, MSc Student  
QOS  
Quantum Optics & Statistics  
Physikalisches Institut Universität Freiburg  
Albert-Ludwigs Universität Freiburg  
Hermann-Herder-Str. 3  
D-79104 Freiburg

**Title:** Transport of High-Dimensional Photonic States  
Across a Turbulent Atmosphere

**Location:** Discussion/Seminar Room H 311  
Faculty of Physics/Ludwig Maximilians University (LMU)

Faculty of Physics  
Research Group Professor Harald Weinfurter/  
Ludwig-Maximilians Universität/Ludwig-Maximilians University (LMU)

CHAIR of Laserspectroscopy / Director Professor Professor Theodor W. HÄNSCH

---

**TRANSPORT of HIGH-DIMENSIONAL PHOTONIC STATES**  
**ACROSS a TURBULENT ATMOSPHERE**

One of the quests of quantum communication is a reliable transmission of high-dimensional photonics quantum states (qudits) through a free-space channel. A common approach to realise qudits is by using light modes carrying orbital angular momentum (OAM). We consider the propagation of photonics OAM qudits encoded in Laguerre-Gaussian modes across a turbulent atmosphere.

We find that the fidelity of the propagated state is a non-monotonic function of the state's dimensionality exhibiting a maximum, however, the optimal fidelity values are too low for secure quantum communication. Therefore, we propose an alternative encoding of audits - into the „eigenstates of atmospheric turbulence“. Using this method, we find high-dimensional states that can be transmitted with high fidelity through the atmosphere.