

# Quantum Optics and Statistics

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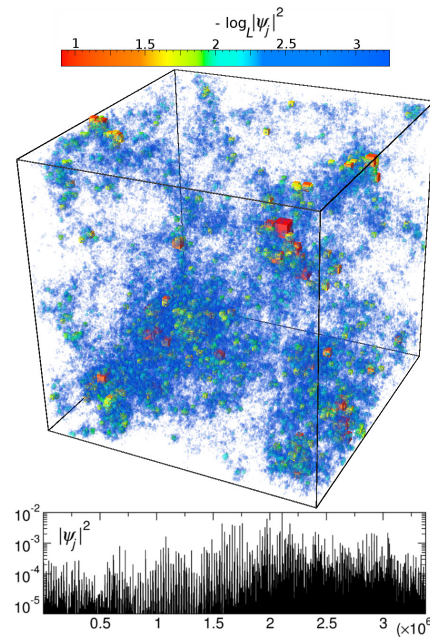
## General research themes:

complex and/or open quantum systems

quantum chaos, statistics, information and control

## Main research topics:

- Free space quantum communication
- Markovian and non-Markovian quantum dynamics
- Foundation of quantum thermodynamics
- Multiparticle entanglement
- Quantum computation
- Localization and multifractality
- Many-particle interference
- Quantum transport



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## Some key questions and problems:

- What defines the arrow of time (via finite memory times) in quantum systems?
- How to measure the degree of irreversible behaviour in nonequilibrium processes?
- How can we quantify the distance between quantum states?
- Can we simulate black hole physics in quantum optics labs?
- Is there a fundamental difference between single and many-particle quantum phenomena?
- Why is it difficult to build a quantum computer which outperforms classical computers?
- How does chaos manifest in the quantum world?
- How do the laws of statistical physics emerge from the microscopic world?
- How to sustain reliable quantum communication channels in a turbulent atmosphere?
- How to witness wave-particle duality in many-particle systems?
- How to sense faint interactions in thermally jiggling environments?
- How to target specific reaction pathways in photochemistry?
- How to measure quantum entanglement?

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## Topics offered by the Quantum Sensing Group,

### Jan Jeske, Thomas Wellens, IAF:

- nanoskalige Magnetfeldmessungen oder Dekohärenzmessungen (scanning probe magnetometry)
- Methodik-Entwicklung oder Anwendung in Material und Nanoelektronikforschung
- Entwicklung eines Lasersystems basierend auf NV Zentren und Einfluss von Magnetfeldern auf die Laserschwelle
- Entwicklung neuer Sensorikmethoden mittels optisch detektierter magnetischer Resonanz zur Detektion von AC Feldern und Strömen

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