# Highly endowed grant for two NIM members

**The NIM members Professor Alexander Högele and Professor Tim Liedl are both awarded with a Starting Grant of the European Research Council (ERC). The grant supports excellent researchers and their forward looking basic research with up to two million Euro.**

## Alexander Högele's Project

Modern communication networks are increasingly based on the transport of modulated light beams along optical fiber networks. But it may soon be possible to use single light quanta (photons) for this purpose, an advance which could enable secure quantum communication. However, this requires the efficient conversion of the light signals into electrical signals at the receiving end, by allowing them to excite electrons in a semiconductor, for instance. Intensive research on the interaction between light and solid-state materials is probing ways to achieve high-efficiency photoconversion, and nanomaterials such as carbon nanotubes represent one promising system for this.

Alexander Högele and his team synthesize their own nanotubes so that they can fine-tune the properties of the material for different experimental situations. Carbon nanotubes are cylinders of about 1 nanometer in diameter, whose walls are made of a monolayer of carbon atoms linked together to form an ordered crystalline lattice. In order to study optical excitations in single nanotubes while minimizing extrinsic effects, the tubes are suspended over a few micrometers. Using this configuration, the researchers found that, following photon absorption, the electrons remained in the excited state for unusually long periods, before recombining with the hole and releasing the absorbed energy as light. The long lifetime of the excited state means that absorption and emission can be spectrally narrow, allowing the nanotubes to be used for high-precision spectroscopy.

The team now hopes to exploit the electron-hole pairs (excitons) produced by photoexcitation to study the mechanical and magnetic degrees of freedom in semiconducting nanotubes. The idea is to use the exciton as an interface between the elementary excitations of light and solid-state matter, providing a way of coupling photons to spins (elementary magnetic excitations) or phonons (elementary mechanical excitations). These experiments may pave the way for the use of carbon nanotubes in future technologies such as / including quantum cryptography and quantum metrology.

Alexander Högele studied Physics at Heidelberg University and at LMU Munich, where he recieved his PhD in 2005. After three years at the Institute of Quantum Electronics at the ETH Zürich, he returned to LMU in 2008 to become a Junior Professor of Experimental Physics. Högele is also a member of the Cluster of Excellence "Nanosystems Initative Munich" (NIM).

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