Carl von Ossietzky
Universität
Oldenburg

Institut für PHYSIK

PHYSICAL COLLOQUIUM

INVITATION

Monday, 24.10.2022, 4.15 p.m., Room W02 1-148 and per
video conference: https://meeting.uol.de/b/anj-2vc-j6s-fwe

speaks

Prof. Dr. Gordon Callsen,
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about

" Linking photonic and thermal properties of semiconductor nanostructures“

During the last decades, significant research efforts were devoted to the optical properties of semiconductor nanostructures, enabling fascinating insight into the underlying physics, which already entailed numerous real-world devices like light-emitting diodes, laser diodes, and various types of quantum light sources. However, the high level of sophistication reached for such photonic devices is often contrasted by scarce knowledge about the related thermal phenomena, ultimately limiting device functionality, efficiency, and longevity. Thus, it shall be the aim to fill this void by bridging the fields of nano-photonics and nano-thermometry based on a unique, hybrid spectroscopic approach that enables simultaneous studies of optical and thermal material properties. Therefore, the envisioned research has to answer the fundamental and in physics often reoccurring question: How can we define and measure temperature on the nanoscale?

Ultimately, the employed hybrid spectroscopy will either probe the temperature of the phonon or charge carrier bath along with the optical material properties, which jointly provide access to the weighting in between the different contributions to thermal transport given by charge carriers, excitons, and thermal THz phonons. Clearly, such spectroscopy needs to spatially and temporally resolve the temperature field across nanostructures, which can be achieved by an optical setup recently developed at the University of Bremen. This optical setup will prove pivotal to an understanding of the transport of thermal phonons and charge carriers, which also requests a thorough understanding of the related couplings. Eventually, this understanding will even pave the way to novel thermal designs and circuits that, e.g., manipulate the flow of heat by means of thermal crystals that can be linked to photonic structures.

In summary, it is the aim to obtain an interlinked physical understanding of photonic and thermal material properties, which will in this talk be exemplified by the discussion of some first experimental results. Future mutual optimizations based on this understanding shall not only benefit classical optical, electrical, and thermoelectric devices (e.g., light-emitting diodes, transistors, Seebeck generators), but even quantum light sources and related circuitry.

All interested persons are cordially invited.

Prof. Dr. Martin Holthaus