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MAX PLANCK LECTURE ON NON-EQUILIBRIUM QUANTUM PHENOMENA

Extreme Photonics with Nanogap Cavities

Maiken Mikkelsen

Duke University,
Durham, USA

Nano- and quantum materials with unique optical properties hold the potential for breakthroughs in a wide range of areas from ultrafast optoelectronics and on-chip components for quantum information science to improved bio-sensing. An exciting opportunity to realize such new materials lies in controlling the local electromagnetic environment on the atomic- and molecular-scale (~1-10 nm), which enables extreme local field enhancements and drastically modified local density of states [1].
We use creative nanofabrication techniques at the interface between chemistry and physics to realize this new regime together with ultrafast optical techniques to probe the emerging phenomena. Here, I will provide an overview of our recent research where we sculpt the electromagnetic fields on the atomic scale to realize ultrafast single photon sources [2,3], high-speed thermal photodetectors with on-chip spectral filters [4] and metasurface-enhanced biosensors [5].

References

1. Nature Materials 18, 668–678 (2019)
2. Nature Photonics 8, 835–840 (2014)
3. Nano Lett. 2016, 16, 1, 270–275
4. Nature Materials 19, 158–162 (2020)
5. Nano Lett. 2020, 20, 6, 4330–4336

Hosts:
Andrea Cavalleri,
Angel Rubio

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