Single-photon emitters in 2D materials

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Atomically thin materials serve as a promising new material class for optoelectronics. Monolayer semiconductors such as MoS_2 or $MoSe_2$ exhibit prominent photoluminescence. Recently, we have discovered bright and stable single-photon emitters in single layers of WSe_2 [1], which renders atomically thin semiconductors also interesting for quantum optics and quantum technologies. In my talk, I will show that these quantum light sources can be controlled by mechanical strain and demonstrate deterministic positioning of the emitters on the nanoscale [2]. Furthermore, I will present single-photon emission from GaSe [3], and demonstrate that the photons can be routed in dielectric waveguides on a photonic chip [4]. Finally, I will discuss the nature and prospects of single-photon emitters in the van der Waals insulator hexagonal boron nitride (hBN) by focusing on the role of phonons [5] and how large emitter arrays can be created with commercially available hBN nanocrystals [6].

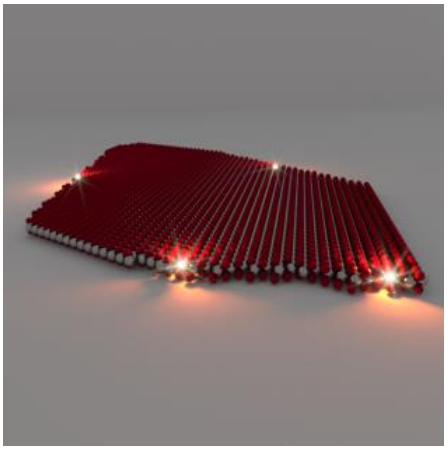

Figure 1: Artistic impression of a WSe_2 monolayer with several single-photon emitters.

References

[1] P. Tonndorf et al., Optica **2**, 347 (2015)
[2] J. Kern, Advanced Materials **28**, 7101 (2016)
[3] P. Tonndorf et al., 2D Materials **4**, 021010 (2017)
[4] P. Tonndorf et al., Nano Letters **17**, 5446 (2017)
[5] D. Wigger et al., 2D Materials **6**, 035006 (2019)
[6] J. A. Preuß et al., 2D Materials **8**, 035005 (2021)