Ultra-bright single photon source based on an atomically thin material

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Solid-state single photon sources are central building blocks in quantum communication networks and on-chip quantum information processing [1]. Atomically thin crystals were established as possible candidates to emit non-classical states of light [2,3], however, the performance of monolayer-based single photon sources has so far been lacking behind state-of-the-art devices based on volume crystals. Here, we implement a single photon source based on an atomically thin sheet of WSe_2 coupled to a spectrally tunable optical cavity [4]. It is characterized by a high single photon purity with a $g^{(2)}(0)$ value as low as 4.7 ± 0.7 % and a record-high first lens brightness of linearly polarized photons as large as 65 ± 4 %. Interestingly, the high performance of our devices allows us to observe genuine quantum interference phenomena in a Hong-Ou-Mandel experiment.
Our results demonstrate that open cavities and two-dimensional materials constitute an excellent platform for ultra-bright quantum light sources: the unique properties of such two-dimensional materials and the versatility of open cavities open an inspiring avenue for novel quantum optoelectronic devices.

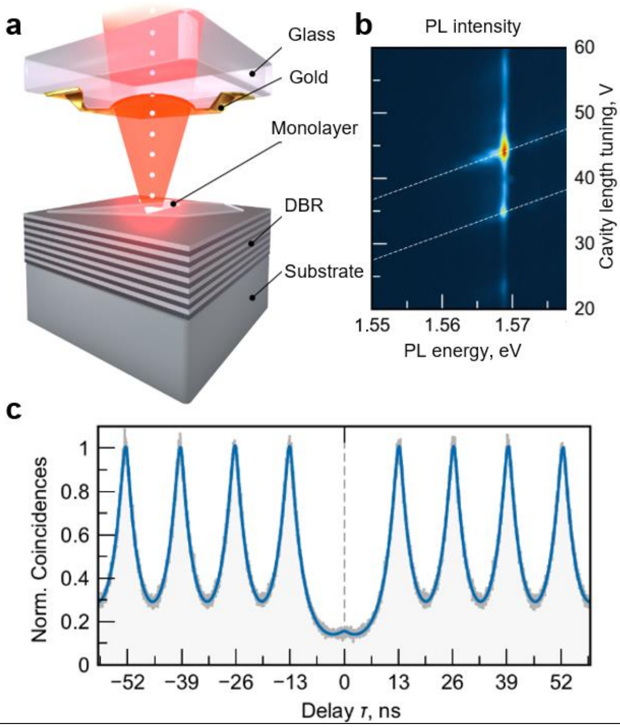

Figure 1: a Single photon emission from a monolayer in a plano-convex open cavity under optical excitation. The relative position of the top and bottom mirror is adjustable by nano-positioners. **b** Photoluminescence spectra upon tuning the cavity optical length for above-bandgap excitation at 532 nm. Cavity modes are highlighted by dashed lines. **c** Second order autocorrelation function of single photons measured in a Hanbury-Brown-Twiss experiment with 76.2 MHz pulsed excitation.

References

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