QLITES
Quantum Light Sources in Solid State Materials and their Applications

Universidad de Oviedo

09-10 February 2026, Oviedo (Spain)

QUANTUM LIGHT SOURCES IN SOLID STATE MATERIALS AND THEIR APPLICATIONS

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GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN
Cofinanciado por la Unión Europea
AGENCIA ESTATAL DE INVESTIGACIÓN

EQUAISE

QLITES

	Monday 09.02.2026
09:30-13:00	EQUAISE & COMPHORT Meetings
13:00-14:30	Lunch
14:30-15:00	Registration & Opening
15:00-15:30	Invited talk: Elena Blundo (TUM)
15:30-15:50	Contributed talk: Antonio Polimeni (La Sapienza)
15:50-16:10	Contributed talk: Giorgio Pettinari (CNR)
16:10-16:40	Coffee Break
16:40-17:10	Invited talk: Carlos Sanchez Muñoz (IFF-CSIC)
17:10-17:30	Contributed talk: Victor Mitryakhin (Univ. of Oldenburg)
17:30-17:40	Workshop Picture
17:40-19:30	Poster Session
20:30-23:30	Dinner

	Tuesday 10.02.2026
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10:30-10:50	Contributed talk: Christopher Gies (Uni. Oldenburg)
10:50-11:10	Contributed talk: Julien Claudon (CEA)
11:10-11:40	Coffee Break
11:40-12:10	Invited talk: Doris Reiter (TU Dortmund)
12:10-12:30	Contributed talk: Julia García Prieto (Univ. Oviedo)
13:00-15:00	Lunch
15:00-15:30	Invited talk: Luca Sortino (LMU)
15:30-15:50	Contributed talk: Juan V. Martinez-Pons (UAM)
15:50-16:10	Contributed talk: David Dlaka (Univ. Bristol)
16:10-16:40	Coffee Break
16:40-17:10	Invited talk: Chanaprom Cholsuk (TUM)
17:10-17:30	Contributed talk: Serkan Ates (Sabancı University)
17:30-17:50	Contributed talk: Robert Behrends (TUB)
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PROGRAMME

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15:30	Contributed: Antonio Polimeni (Sapienza University of Rome, Italy) *Electronic properties of single photon emitters in transition metal dichalcogenide micro-domes*
15:50	Contributed: Girogio Pettinari (Institute for Photonics and Nanotechnologies CNR, Italy) *Bull's eye cavities for TMDC-based single photon emitter integration*
16:10	Coffee Break
16:40	Invited: Carlos Sánchez Muñoz (Institute of Fundamental Physics IFF-CSIC, Spain) *On-demand single-photon source over the terahertz regime*
17:10	Contributed: Victor N. Mitryakhin (University of Oldenburg, Germany) *Monolayer Single Photon Emitter Coherently Driven through Its Excited State*
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10:30	Contributed: Christopher Gies (University of Oldenburg, Germany) *TBA*
10:50	Contributed: Julien Claudon (University of Grenoble Alpes, CEA, France) *Indistinguishable single photons from a quantum dot in a nanopost cavity*
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13:00	LUNCH
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ABSTRACTS
INVITED
SPEAKERS

Moiré trapping of excitons in 2D heterostructures

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The weak van der Waals interaction that keeps the layers together in layered crystals has opened new avenues for heterostructures, introducing a new degree of freedom: the twist angle. Twisted 2D HSs have attracted great attention for the fascinating physics they unleash. The twisting leads in fact to the formation of a periodic interference pattern, the moiré pattern (Fig. 1a), which results in the creation of a periodic potential for charge carriers that is twist-dependent and strongly affects the system (opto)electronic properties. In semiconducting HSs based on transition metal dichalcogenides (TMDs, such as $MoSe_2$ and WSe_2) interlayer excitons (with electrons and holes lying in the different constituent materials of the HS) form (Fig. 1b). Interlayer excitons are further trapped by the moiré potential, offering a means to tune their properties and showing promise for the formation of Bose-Einstein condensates and highly correlated exciton states, or as nanoscale-ordered quantum emitters [1].

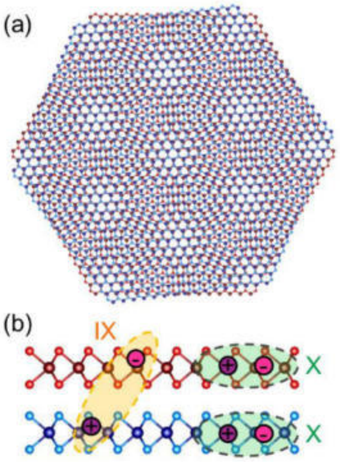

Fig. 1. Sketch of a TMD HS. (a) Top view, showing the formation of a moiré pattern (twist angle equal to 7°). (b) Side view, showing the formation of interlayer excitons (IXs), besides intralayer excitons (Xs).

In this talk, we address the properties of moiré-trapped excitons in TMD HSs, shedding light on their origin and nature and thus on their potential for quantum applications. An analysis of the exciton lineshape demonstrates clear evidence of moiré trapping [2], along with the involvement of phonons in shaping the spectrum [3]. More specifically, photoluminescence measurements of $MoSe_2/WSe_2$ HSs clearly reveal the presence of spectrally narrow discrete emission lines conventionally associated with moiré-trapped interlayer excitons. A strikingly uniform line-spacing of the discrete emission lines is observed, suggesting an entirely new picture of the discrete interlayer exciton emission in which non-thermal phonons play a crucial role in shaping the spectrum. An analysis of the PL spectrum of the intralayer excitons in these HSs further reveal the role played by the moiré potential in affecting exciton physics in 2D superlattices.

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On-demand single-photon source over the terahertz regime

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We propose a deterministic single-photon source in the terahertz (THz) regime, triggered by a sequence of coherent optical pulses [1]. The scheme leverages the permanent dipole moment of a single-polar quantum emitter to induce THz transitions between optically dressed states, enhanced by a resonant coupling to a hybrid THz cavity [2]. We present a cavity design that delivers high efficiency, purity, and indistinguishability while also enabling easy tunability of the emission frequency across the THz range. A key challenge in this new class of dressed-state sources is that, unlike standard solid-state single-photon sources, the dressed nature of the transitions can lead to undesired optical repumping during emission due to spontaneous photon emission in the visible range, which reduces the purity of the THz single-photon state. We show that this issue can be mitigated through optimized pulse areas and a sufficiently high Purcell rate, criteria that are met by our proposed cavity design. Finally, we demonstrate the significant purity enhancement of postselected THz photons by means of optical heralding, illustrating the new opportunities unlocked by the unique integration of terahertz and visible technologies with dressed polar quantum emitters.

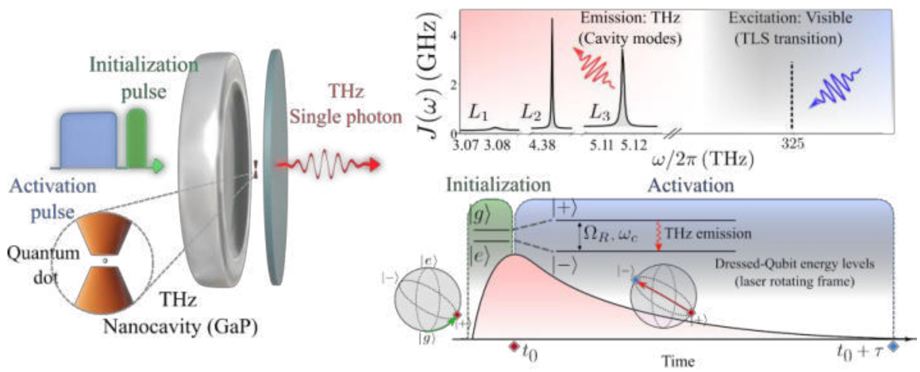

Figure 1: Overview of a proposed deterministic single-photon THz source based on a quantum emitter in a hybrid nanocavity formed by GaP nanocones inside a Fabry–Pérot resonator. The system is driven by optical pulse protocols to initialize and activate THz emission, with simulations illustrating emitter dynamics.

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Photoluminescence of hBN single-photon emitters in a near-field microscope

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Single-photon emitter (SPE) in hexagonal boron nitride (hBN) have emerged as intensively investigated quantum light sources due to their stable and bright single-photon emission at room temperature.

We utilize a scattering-type near-field optical microscope (s-SNOM) to study the photoluminescence (PL) emission characteristics of such quantum emitters in metalorganic vapor phase epitaxy grown hBN [1]. In our specific experiments, we employ the near-field optical microscope in tapping mode, to detect PL signals influenced by the presence of the metallic tip.

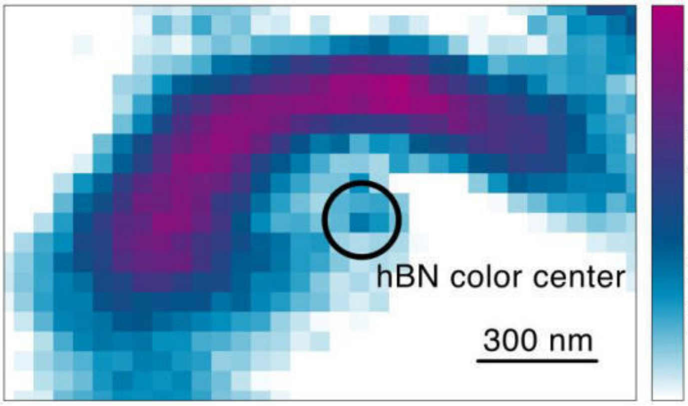

Figure 1. Photoluminescence intensity map of a single color center taken in a near-field microscope.

On the one hand, we demonstrate direct near-field optical excitation and emission through interaction with the nanofocus of the tip resulting in a sub-diffraction limited tip-enhanced PL hotspot. This signal appears as dot in the map in Fig. 1, marked by the circle. On the other hand, we observe a more pronounced ‘arc’ around the dot (violet area). We explain this feature by constructive interference between direct beams to/from the SPE and those scattered from the AFM tip (indirect beams) leading to a significant increase of the recorded PL intensity. We apply the TAPL method to map the in-plane dipole orientations of the hBN SPEs.

References

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Interplay of excitation and cavity in shaping photons from solid-state quantum emitters

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For the generation of photons with optimal properties, the excitation process of quantum emitters plays a crucial role. Over the past years, several coherent excitation schemes beyond resonant excitation via Rabi oscillations have been developed and implemented for quantum dots, including adiabatic rapid passage, the detour scheme and the Swing-up of quantum emitter population (SUPER) scheme. While each of these schemes has its respective advantages and disadvantages, the impact of the excitation scheme on the photon properties becomes even more prominent when the quantum emitter is placed inside a cavity. Because the cavity frequency acts as a filter, this gives rise to novel mechanisms that in turn affect the properties of the emitted photons.

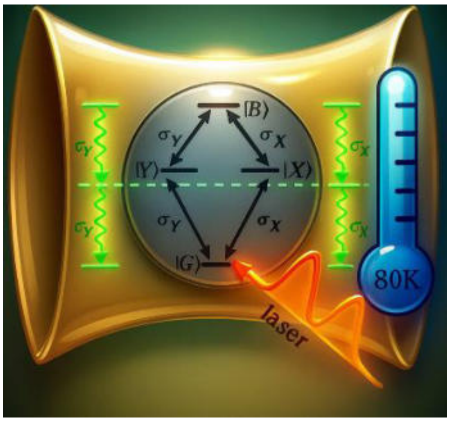

Figure 1 Artistic version of a four-level quantum emitter in a cavity excited by two

In this talk, I will discuss two examples where the interplay between excitation scheme and cavity enhances photon properties. First, when a quantum dot acts as a source of polarization entangled photons, resonant excitation yields imperfect excitation due to Stark shifts during the pulse. However, if the quantum dot is excited via the SUPER scheme, near unity concurrence can be achieved, which remains almost perfect even at elevated temperatures [1].

As a second example, I will discuss the impact of the excitation process on the photon number coherence (PNC) of the emitted photons [2]. While in resonant excitation the pulse area can in principle serve as a tuning knob for the PNC, phonons that are typically known to destroy coherences can surprisingly enhance it [3]. Within the SUPER scheme, the PNC can become stronger than under resonant excitation.

These examples illustrate that it is crucial to account for the excitation process when evaluating the quality of a quantum emitter.

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Integrating 2D quantum emitters with nanophotonic structures

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Engineering light-matter interactions within tailored photonic environments offers a powerful route to enhance and control quantum emission, enabling the realization of efficient single-photon sources. Two-dimensional semiconductors and other van der Waals layered materials host atomically thin quantum emitters that can be spectrally and spatially tuned, making them ideal candidates for integrated quantum photonics. Their compatibility with photonic architectures further allows to study coupling to passive nanoscale dielectric resonators for enhanced emission control.

In this talk, I will present experimental results on coupling WSe_2 quantum emitters to dielectric nanoantennas [1], and on integrating optically active defects in hBN with high-Q factor optical metasurfaces [2]. Together, these approaches illustrate a versatile platform for scalable quantum nanophotonics, where emission properties, coherence, and efficiency can be engineered within a compact solid-state environment.

References

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Solid-state hBN single photon sources for quantum communication

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Reliable single photon generation lies at the heart of quantum communication. While pseudo single photon sources have been widely used, true single photon sources can significantly improve data transmission rates and overall system performance. One of the most elegant implementations relies on the fluorescence of a single two-level quantum system: since excitation and emission between ground and excited states occur over a finite time, the emitter can ideally release one photon per excitation cycle. In this talk, I will present such a system originating from atomic-scale defects in two-dimensional hexagonal boron nitride (hBN). The comprehensive properties of these defects have been theoretically characterized and compiled in our online database, https://h-bn.info [1]. These hBN quantum emitters offer high quantum efficiency and single-photon purity at room temperature [2].

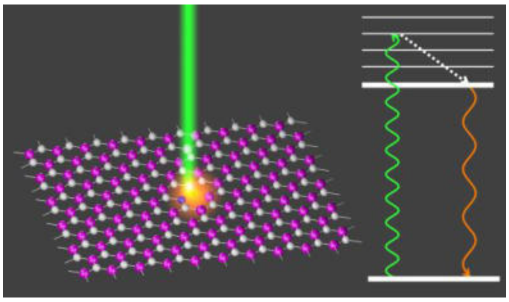

Figure 1. Single photon emission from a defect in hBN arising from transitions between two-level defect states.

I will then discuss how these systems can be harnessed for quantum memories and satellite-based quantum communication, highlighting our work on the QUICK3 satellite mission [3]. Finally, while the conventional Gottesman–Lo–Lütkenhaus–Preskill (GLLP) formalism ensures security against photon-number-splitting (PNS) attacks by demanding extremely low second-order correlation $g^{(2)}(0)$ values, we have developed a decoy-like protocol that relaxes this strict requirement [4]. By exploiting $g^{(2)}(0)$ variation as a diagnostic tool, our approach securely enables the use of single photon sources even with $g^{(2)}(0) > 0.5$, a regime routinely achieved in experiments but rarely considered viable for quantum key distribution (QKD). Therefore, hBN defects represent a promising platform that offers a practical and broadly applicable route toward high-performance quantum communication.

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ABSTRACTS
CONTRIBUTED
SPEAKERS

Electronic properties of single photon emitters in transition metal dichalcogenide micro-domes

Salvatore Cianci[1], Elena Blundo[1], Federico Tuzi[1], Nikodem Sokołowski[1], Giorgio Pettinari[2], Katarzyna Olkowska-Pucko[3], Antonio Miriametro[1], Takashi Taniguchi[4], Kenji Watanabe[5], Adam Babinski[3], Maciej R. Molas[3], Marco Felici[1], Antonio Polimeni[1]*

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The presence of single photon emitters (SPEs) in two-dimensional (2D) crystals is certainly a valuable asset of these systems. Several 2D materials, including semiconducting transition metal dichalcogenides (TMDs), hexagonal boron nitride (hBN), GaSe, and MoO_3 host defect states that give rise to quantum emission.[1] The exceptional mechanical properties of 2D materials along with their manageability and relatively easy integration in photonic structures made the SPEs therein embedded particularly attracting. SPEs based on TMDs are especially important since they prompt a rather wide palette of quantum emission energis and the possibility to tune their emission via mechanical deformations.[2] Indeed, the strain itself is deemed to be at the origin of the formation of SPEs in 2D TMDs.[3]

In this work, we address the physical origin of SPEs in WS_2. To this end, we exploit the peculiar formation of hydrogen-filled micro-domes obtained by low-energy (10 eV) proton irradiation.[4] The micro-domes are subjected to internal pressures as high as hundreds of atm. The ensuing high strain values attained promote an especially favourable electronic configuration, whereby defect levels admix with extended state levels leading to intense and narrow emission lines featuring quantum properties.[5] Magneto-optical provide compelling evidence of the involvement of dark states at the origin of SPEs, while emission polarization studies emphasize the role of strain.

References

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Bull’s eye cavities for TMDC-based single photon emitter integration

Daniele Cecchetti[1] and Giorgio Pettinari[1*], on behalf of EQUAISE collaboration
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Single-photon emitters (SPEs) are key building blocks for emerging quantum technologies. Efficient SPE generation has been routinely demonstrated in two-dimensional (2D) materials such as hexagonal boron nitride (hBN) and transition metal dichalcogenides (TMDCs, e.g., WSe_2, WS_2, $MoSe_2$). Within the *EQUAISE* project (*Enabling QUAntum Information by Scalability of Engineered quantum materials*), funded under the QuantERA II Cofund 2021 EU programme, we have developed a new approach for the realization of SPEs based on strained 2D TMDCs and their integration into Bull’s Eye (BE) optical cavities, aiming to enhance and control photon extraction [1,2].

In this contribution, we report on the fabrication of BE cavities in silicon nitride (Si_3N_4) membranes, either sputtered on conventional semiconductor substrates (i.e., Si or GaAs wafers) or directly deposited onto piezoelectric substrates to enable strain control of the cavity properties. The cavity design has been optimized through finite-difference time-domain (FDTD) simulations to match the emission energy of SPEs in WSe_2 and WS_2 monolayers, respectively around 750 nm and 650 nm. Cavity fabrication was carried out by electron-beam lithography (EBL) and dry etching. First results of BE cavities fabricated on membranes directly sputtered on piezoelectric substrates will be presented and compared with simulations.

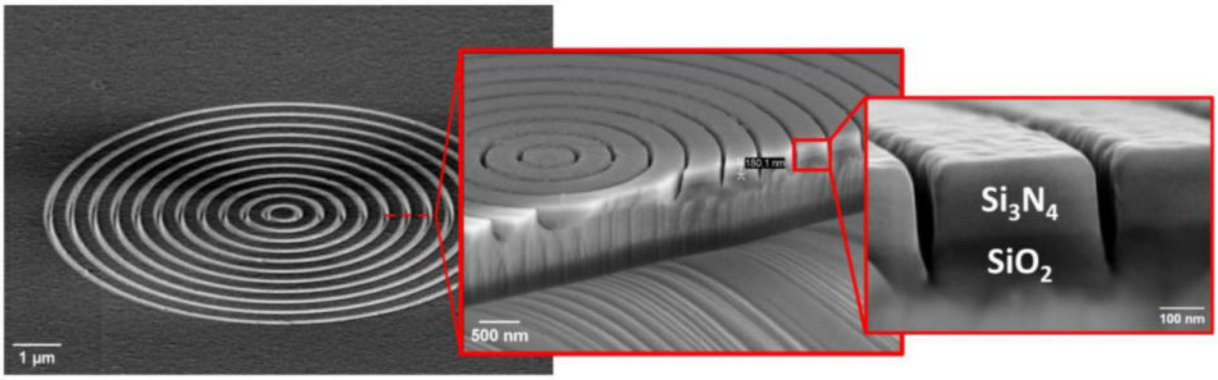

Figure 1. SEM image of a Bull’s Eye (BE) cavity fabricated on a Si_3N_4/SiO_2 membrane deposited on a GaAs substrate. The zoomed-in images show a 60°-tilted view and a cross-sectional view along the cut indicated by the red dashed line.

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Monolayer Single Photon Emitter Coherently Driven through Its Excited State

Victor N. Mitryakhin[1*], Ivan A. Solovev[1], Alexander Steinhoff[1], Jaewon Lee[2], Martin Esmann[1], Ana Predoević[1, 2], Christopher Gies[1] and Christian Schneider[1]

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The recent discovery of single photon emitters in novel two-dimensional materials such as transition metal dichalcogenides (TMD) [1] has drawn explicit attention of the quantum optics community. Relative inexpensiveness and ease of fabrication, along with an ability to deterministically seed such emitters and integrate them with photonic and plasmonic structures [2], have given rise to a particular interest for their use in quantum technologies. However, a significant limitation on possible applications of such single photon sources (SPS) has been revealed by the recent studies of their coherence properties showing severe decoherence effects, e.g. due to strong phonon coupling [3]. Though the impact of the latter can be reduced by integration of single emitters into photonic structures [4], a well-established method to mitigate decoherence effects is to use resonant excitation schemes.

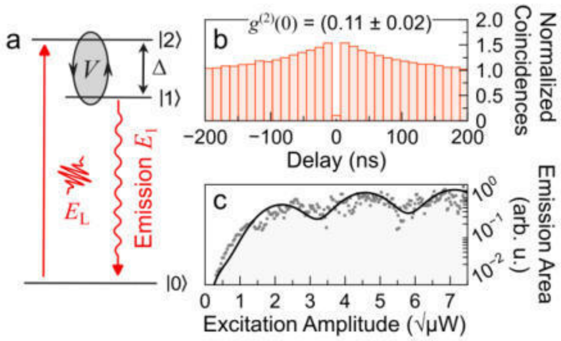

Figure 1. (a) Scheme of the energy level structure (b) Second-order correlation chart of the emission under pulsed excitation. (c) Normalized area of PL emission vs square root of power of a laser tuned to the higher state

In this work, we show resonant excitation of a SPS in WSe_2 monolayer flake by driving it through its excited state (see Fig. 1a). We investigate its energy level structure by means of photoluminescence excitation spectroscopy, which in turn reveals multiple resonances, some of which we attribute to higher-lying electronic shells. Consequently, the single photon character of the emission is studied in a typical Hanbury-Brown-Twiss experiment, while the emitter is excited through one of such resonances (see Fig. 1b). Then, we carry out a series of measurements, while pumping into the aforementioned resonance and monitoring the intensity of emission as a function of the pump field amplitude. Here, we observe an oscillatory behavior manifesting emergence of Rabi oscillations (see Fig. 1c). At last, we explain this behavior by examining a problem of a three-level system with introduction of a coupling and electric field pump terms to the Hamiltonian of the system.

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Indistinguishable single photons from a quantum dot in a nanopost cavity

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On-demand and wavelength-tunable sources of identical single photons are key devices for scaling up photonic quantum technologies. Semiconductor quantum dots (QDs) are artificial atoms with remarkable optical properties. To enable wavelength tuning, a single QD should ideally be integrated in a photonic structure that maintain a large Purcell acceleration of spontaneous emission over a broad spectral range.

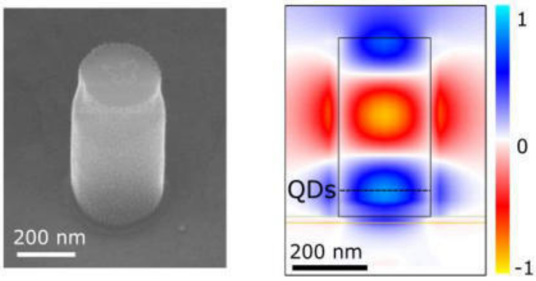

Figure 1. Left: Scanning electron micrograph (tilted view) of a representative device. Right: Map of the electrical field of the cavity resonance.

We introduce here the nanopost optical cavity, a simple photonic nanostructure that provides a large Purcell acceleration (up to 7 at resonance) over a broad range of wavelengths (30 nm at half maximum) [1]. We next present two recent experiments performed on a self-assembled InAs QD embedded in a Gas nanopost cavity. In the first one, we excite resonantly the QD with a continuous wave laser and detect its resonance fluorescence with a large signal-to-background ratio [2]. Linescans and intensity autocorrelation measurements reveal an excellent single-photon purity ($g^{(2)}(0) = 2\%$) and a close to lifetime-limited homogeneous linewidth (40% above the Fourier limit). In the second experiment, we employ a pulsed, quasi-resonant excitation scheme to deterministically excite the emitter and explore photon-photon interference of consecutive photons emitted by the source [3]. For two photons separated by 2 ns, we obtain a Hong-Ou-Mandel wavepacket overlap as high as 53%.

These results, combined with further improvements of the device, pave the way for the realization of broadly-tunable sources of single and indistinguishable photons.

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Reversible Strain Control of Quantum Emitters in 2D Semiconductors

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In recent years, atomically thin semiconductors based on transition-metal dichalcogenide (TMD) monolayers have emerged as a versatile platform for solid-state quantum emitters (QEs), combining exceptional optical quality with intrinsic mechanical flexibility [1]. This remarkable stretchability allows their optical response to be tuned over a wide range through elastic strain engineering [2]. Although the microscopic origin of QEs is still under active investigation, limiting the deterministic fabrication of identical emitters, it is widely accepted that their formation is closely linked to local strain fields and lattice defects. Position-controlled QEs can thus be realized by introducing static strain gradients via nanoscale features such as pillars or bubbles, which funnel excitons into localized regions where quantum light emission occurs [3].

Here, we present our recent results on the reversible tuning of the emission energy and brightness of QEs in WSe_2 monolayers. This control is achieved using a hybrid semiconductor–piezoelectric platform, in which the monolayer is integrated onto piezoelectric nanopillars that generate both static and dynamic strain fields. By combining numerical simulations with exciton drift–diffusion modeling, we demonstrate that these strain fields reshape the confining-potential landscape, leading to a reversible redistribution of excitons among individual emitters [4]. Finally, we present complementary high-resolution optical and structural characterization at the nanoscale, which provides a quantitative mapping of the static strain in nanobubbles, a key aspect in the formation of QEs in TMD monolayers.

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Open Fabry-Pérot cavities for bright single photon generation at room temperature

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Single-photon sources are a key resource for many of the applications envisioned in quantum photonics. In particular, solid-state emitters are highly attractive, as they enable integration into optical circuits and compact devices, and have been shown to offer higher efficiencies than probabilistic sources [1,2]. Moreover, single-photon emission at room temperature opens the door to the implementation of quantum key distribution protocols and true random number generation, where fast decoherence rates are not a limiting factor since quantum entanglement is not required. To increase the brightness of these emitters, resonant optical cavities can be used which, through the Purcell effect, modify the photonic density of states and therefore reduce the radiative decay time of the emitter, increasing its emission rate [3].

In this work, we address the challenge of developing such a solid-state single-photon source operative at room temperature, based on hBN defects resonant to a single mode of a tunable Fabry-Pérot concave-plane microcavity. We present the characterization of our source, showing single-photon emission, and we discuss its design and operation protocol. We show that a good match between the defect emission and the cavity mode is crucial for maximal brightness, which poses extra challenges at room temperature such as the need to use a cavity design with low quality factor, nearly optimal mirror alignment, and good mechanic stability of the device.

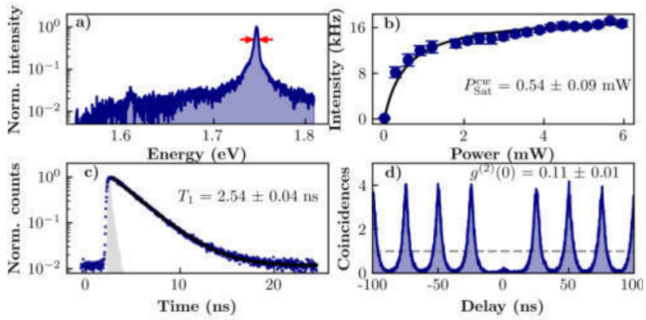

Figure 1. Basic characterization of an hBN defect outside the optical cavity showing **a)** PL spectrum, **b)** Saturation curve, **c)** Spontaneous decay histogram, **d) Second order correlation function under pulsed excitation.**

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Enhancing Room-Temperature Single Photon Sources with Open Cavity Systems

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The ability to extract single photons at (near) unity efficiency remains a topic of interest in the community, producing a variety of structures and devices. Open cavity structures are an attractive contender due to the possibility of precise spatial alignment to an emitter, Purcell enhancement to increase the efficiency and emitter rate, as well as the ability to shape the emission for mode-matching to a single mode fibre [1][2]. In this work, we simulate structures with varying structural parameters (Fig. 1) to test device performance of a wide, to reflect devices which may not require the very intricate engineering required to align the two mirrors at a distance of ~few µm.

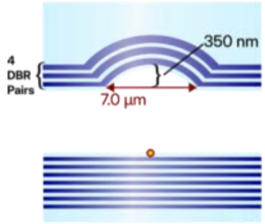

Figure 1. Schematic of the simulated open cavities and the variable parameters.

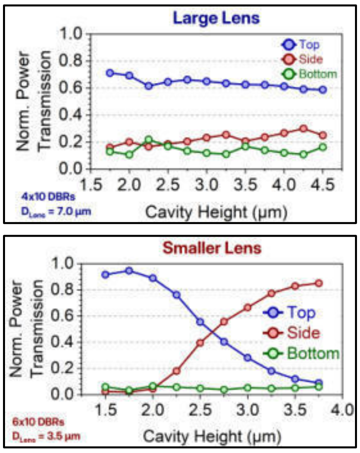

Figure 2. The normalised power transmission for a large RCurv~16um (top) and a smaller RCurv~5um (bottom) structure.

We find that the curvature of the top DBRs provides radial confinement of the cavity E-field, increasing the Purcell enhancement of the cavity mode at the cost of requiring a lower distance between the mirrors, labelled cavity height (Fig. 2). Large R_{Curv} structures are insensitive to cavity height and do not demand technically intricate <2um mirror distances, but offer less on-peak efficiency.

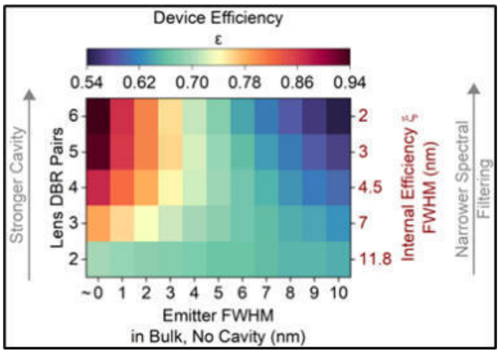

Figure 3. The efficiency of the device integrated over the entire spectrum appears as function of the cavity and emitter FWHM.

We also investigate the efficiency integrated over the full spectrum (labelled device efficiency) as a function of both the FWHM of the spectral filter of the cavity, and the FWHM of the emitter in bulk (Fig. 3), demonstrating the ability to extract ~70% of emitted photons from a room temperature emitter with bulk FWHM ~5 nm and as high as 94% if cryogenically cooled. This demonstrates the potential of achieving record-breaking efficiency and count-rates from room temperature emitters with a wide range of applications in quantum communications.

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Quantum key distribution using single photons from defects in hexagonal boron nitride

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The widespread adoption of Quantum Key Distribution (QKD) requires developing practical, high-performance single-photon sources (SPSs) that operate at room temperature. Among several SPSs, defects in hexagonal Boron Nitride (hBN) have emerged as a potential candidate, offering bright and stable single-photon emission without cryogenics. This presentation summarizes our comprehensive work advancing hBN emitters from initial viability to high-speed performance.

We first established a proof-of-concept demonstration of free-space QKD based on the B92 protocol using an hBN defect [1]. This system, operating at a 1 MHz clock rate, achieved a sifted key rate of 238 bps with a Quantum Bit Error Rate (QBER) of 8.95%, confirming the fundamental suitability of hBN defects as a practical SPS for real-world quantum communication.

Building on this, we engineered a high-speed QKD system, also implementing the B92 protocol, to push the performance limits [2]. By implementing a resonant Electro-Optic Modulator (EOM), as opposed to a broadband one, we increased the operation speed to 40 MHz. This key upgrade resulted in a dramatic improvement, yielding a sifted key rate (SKR) of up to 17.5 kbps, a secure key rate of 7 kbps, and a significantly reduced QBER of 6.49%.

Finally, to underpin the development of such polarization-based protocols, we performed a fundamental study of the polarization properties of hBN single-photon sources [3]. Using Time-Resolved Stokes Polarization Analysis, we characterized the emitters' complex polarization dynamics. This work is crucial for understanding and minimizing errors in any QKD protocol that relies on a polarization-encoding scheme.

In summary, this work establishes hBN defects as a leading platform for next-generation quantum communication technologies, including promising applications for space-based QKD systems without the need for cryogenic conditions.

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GHz-clocked Generation of Highly Indistinguishable Photons in the Telecom C-band

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Many photonic quantum technologies rely on sources providing single and indistinguishable photons on demand and at high rates.

Here we present an ultra-fast quantum dot (QD) single-photon source in the telecom C-band, based on InAs/InAlGaAs QD integrated in a circular Bragg grating cavitiy. We observe record-short biexciton decay time of T_1 = 68 ps under resonant two-photon-excitation (TPE), which allows us to generate highly indistinguishable single photons at clock rates > 1 GHz. The two-photon interference visibility of photons emitted via the biexciton-exciton transition was measured in a Hong-Ou-Mandel-type experiment to be 92.4% and 82.6% at clock rates of 100 MHz and 2.5 GHz, respectively. Applying stimulated TPE in the telecom C-Band for the first time, we show that the photon indistinguishability can be further enhanced for exciton photons.

Our results show promises to advance QD-based implementations of quantum cryptography to unprecedentedly high clock rates at wavelengths suitable for large-scale fiber-optic networks.

ABSTRACTS
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