Hexagonal boron nitride (hBN) is a wide bandgap semiconductor (~ 6 eV) that has recently attracted large interest. In its hexagonal form, boron nitride is a layered two dimensional material. Due to the very similar honeycomb structure, hBN is sometimes referred to as "white graphene". However, instead of the carbon atoms, the structure is made of boron and nitrogen. As graphene, hBN has strong covalent bonds in-plane, whereas in the vertical direction between adjacent layers only week van der Waals forces are present. Due to its layered structure, hBN can be thinned down to or be grown as a single atomic layer.

The rising interest in hBN in recent years has partly been sparked by the finding that hBN is the most-suitable substrate for graphene and other 2D crystals (e.g. transition metal dichalcogenides (TMDs)). Graphene transferred on hBN shows extraordinary electrical properties with record carrier-mobilities, otherwise only achievable in suspended layers. TMDs (e.g. MoS_2, WSe_2) passivated by hBN show, similarly to graphene, a significant improvement of optical and electronic properties.

A few years ago, a new aspect has been unveiled that adds to rising interest in hBN: **single photon emission at room temperature from deep defect states.** This discovery led to an extremely fast emerging field, also driven by exciting possible applications in quantum communication and cryptography.

However, although hBN plays a key role in the vibrant field of two-dimensional crystals, the most common fabrication method of hBN is still manual mechanical exfoliation**. In this proposal we tackle this issue with a different approach by fabricating wafer-scale BN of excellent quality by MOVPE with adjustable growth parameters to deterministically tailor the properties of our layers in terms of single photon emission.**

In order to fully harvest the potential of these emitters, an enhancement of emission can be achieved by the implementation into a dielectric nanostructure. In this project we propose an innovative solution which employs distributed Bragg reflectors (DBR) grown during a single MOVPE process. These DBRs can be employed to obtain the desired selective enhancement in emission.

The fact that we employ epitaxial hBN opens up new possibilities for studying the physical effects of defects in this material, but can prove equally important for future possible industrial scale applications. The studies proposed in this project will allow to take first steps towards an **optically pumped on-demand all-hBN single photon source**, **by deepening the basic knowledge on single photon emitters and their incorporation into innovative nanosystems**.