Spatial distribution of blue quantum emitters in hexagonal boron nitride induced by electron beam irradiation.

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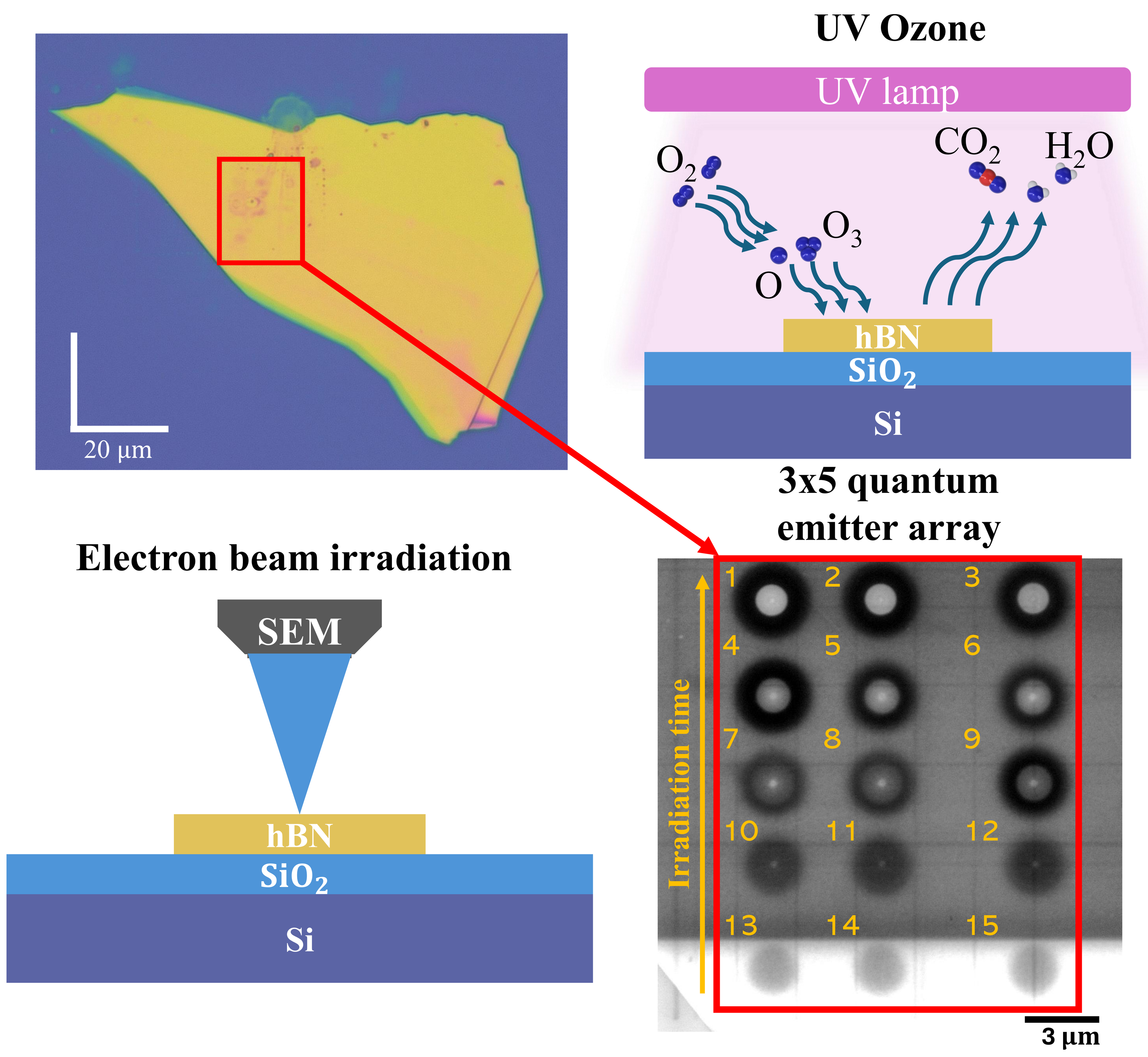
Abstract

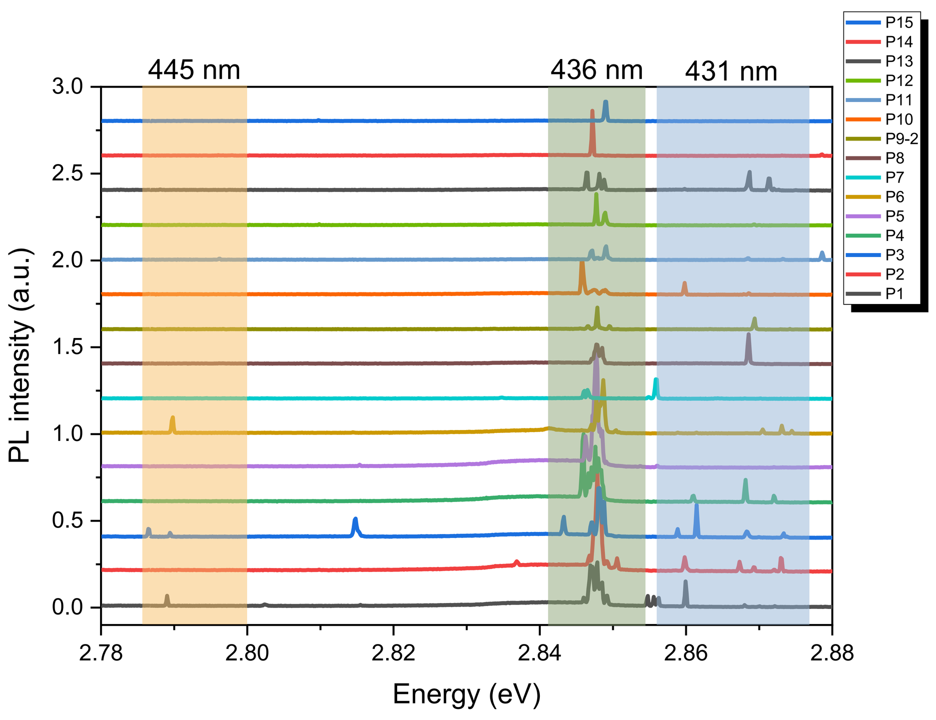
Hexagonal boron nitride (hBN) has emerged as a promising host for stable quantum emitters, with blue emission centers offering potential for applications in quantum photonics and nanoscale sensing. A key advantage of these emitters is their ability to release one photon at a time, which is essential for secure quantum communication and scalable photonic quantum technologies. Achieving precise control over the spatial positioning of such single-photon sources is therefore crucial for integrated quantum devices and photonic circuits. In this work, we employ confocal photoluminescence (PL) mapping to investigate the spatial distribution of blue emission centers in hBN flakes created by electron beam irradiation. By classifying different emitters, we aim to compare their spatial localization and distribution characteristics, providing insights into the controlled generation and deterministic placement of single-photon sources in hBN. Our work shows that these quantum emitters are highly promising candidates for integration into future quantum photonic circuits.

Keywords: blue quantum emitters, hexagonal boron nitride, photoluminescence

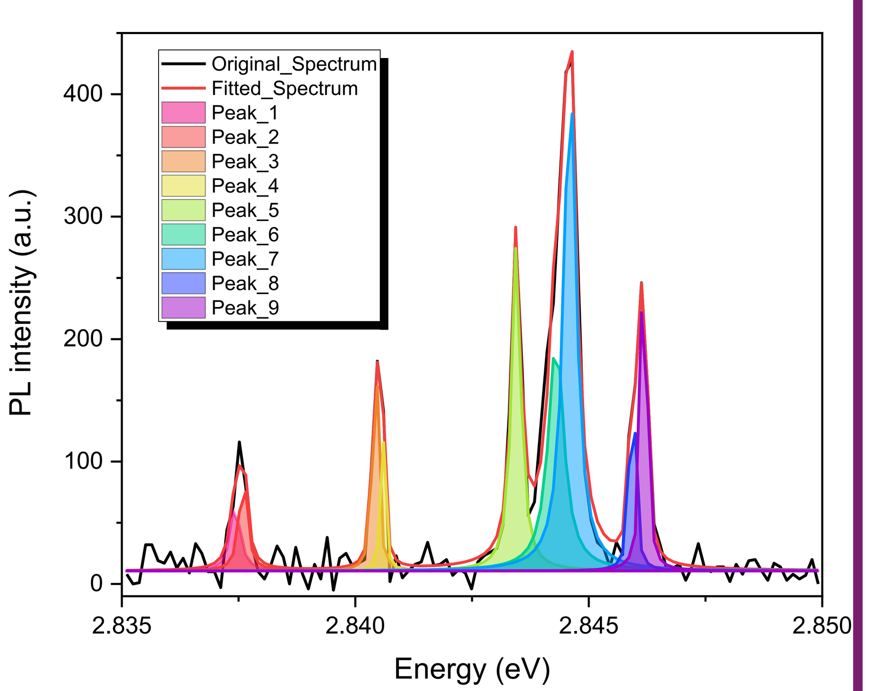
Sample Fabrication

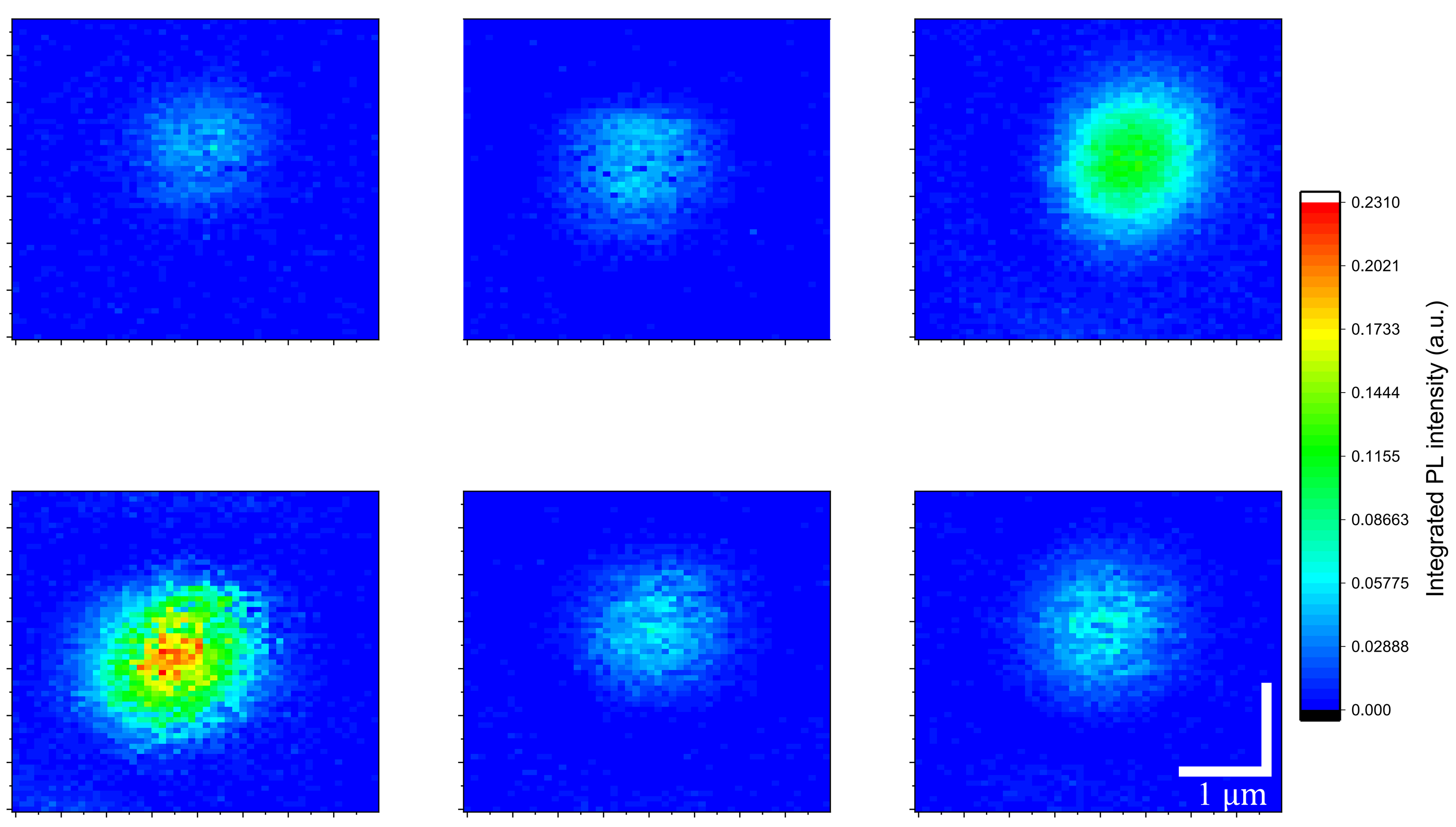


Photoluminescence at 4 K

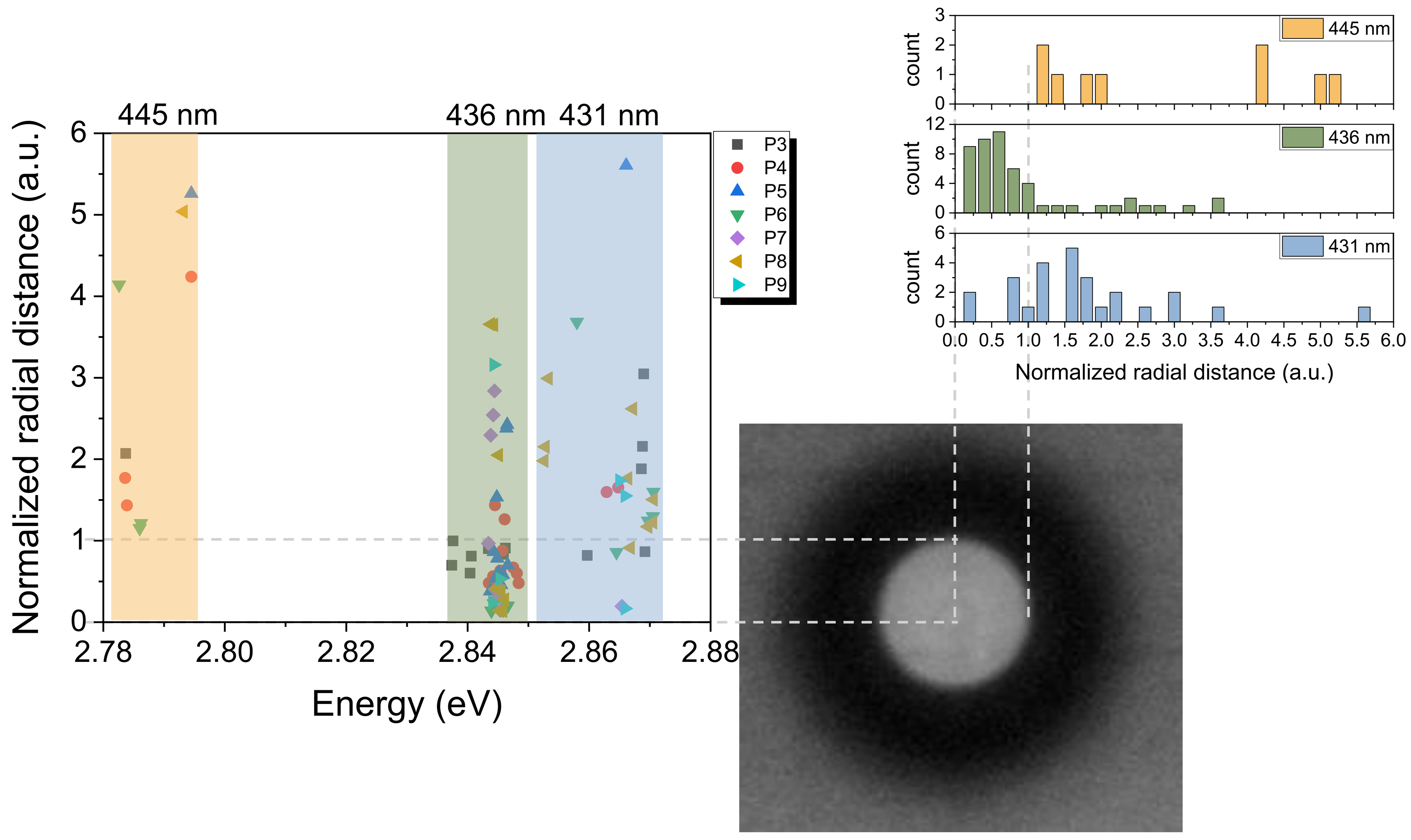


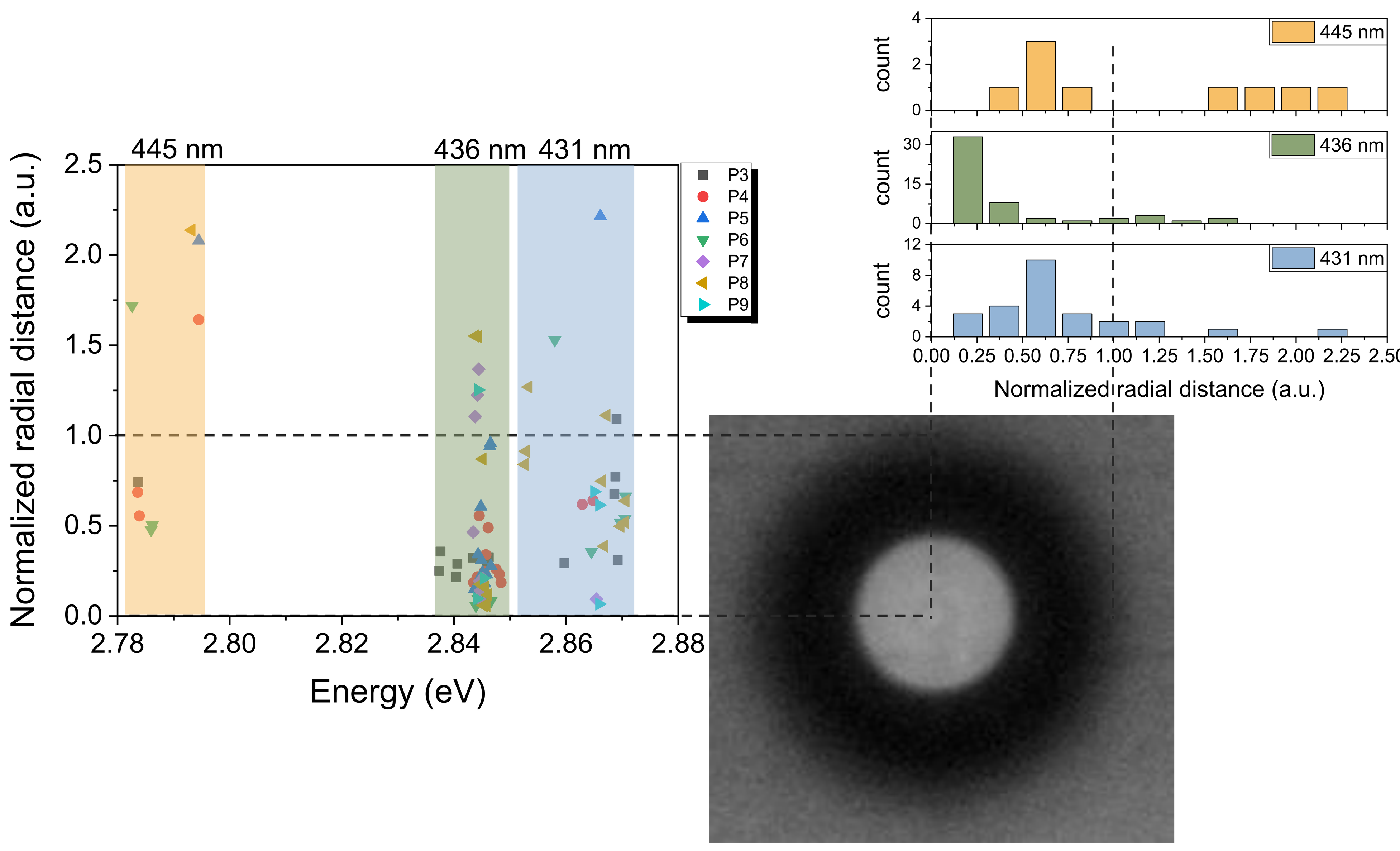
Lorentzian fitting





Spatial distribution of QEs





Conclusion

The most common and brightest quantum emitters at 436 nm preferentially appear within the white regions, whereas emitters at 431 nm tend to be located in the black regions. In contrast, the 445 nm emitters appear to be randomly distributed.

Reference and Acknowledgement

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