Quantum Emitters in Aluminium Gallium Nitride

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Point-like emitters in the commercially important $Al_xGa_{1-x}N$ semiconductors have been found in as-grown epilayers [1] and created using ion-implantation [2] and femtosecond laser writing. These emitters saturate and exhibit antibunched emission at room temperature, which is indicative of a quantized emitter. Furthermore, it was recently shown that emitters in GaN can host single spin qubits amenable to optically-detected magnetic resonance spectroscopy [3] which opens the possibility of spin-based sensors in the III-nitrides. We have studied the photodynamics of a class of emitters identified in various $Al_xGa_{1-x}N$ epi-wafers. At room-temperature their spectra are dominated by a broad phonon side-band, with a weak zero phonon line near red to near-IR spectral range. All emitters display linear absorption and emission dipoles, which are not parallel, and are not well aligned to the crystallographic axes [4]. The photodynamics, under pulsed and CW excitation, are governed by multiple dark 'shelving states', resulting in complex multi-exponential autocorrelations [5].

References

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Short Bio:

Professor Anthony Bennett has worked at Cambridge University, Imperial College London and Toshiba Research Europe. He is currently Professor at Cardiff University in Wales, UK.