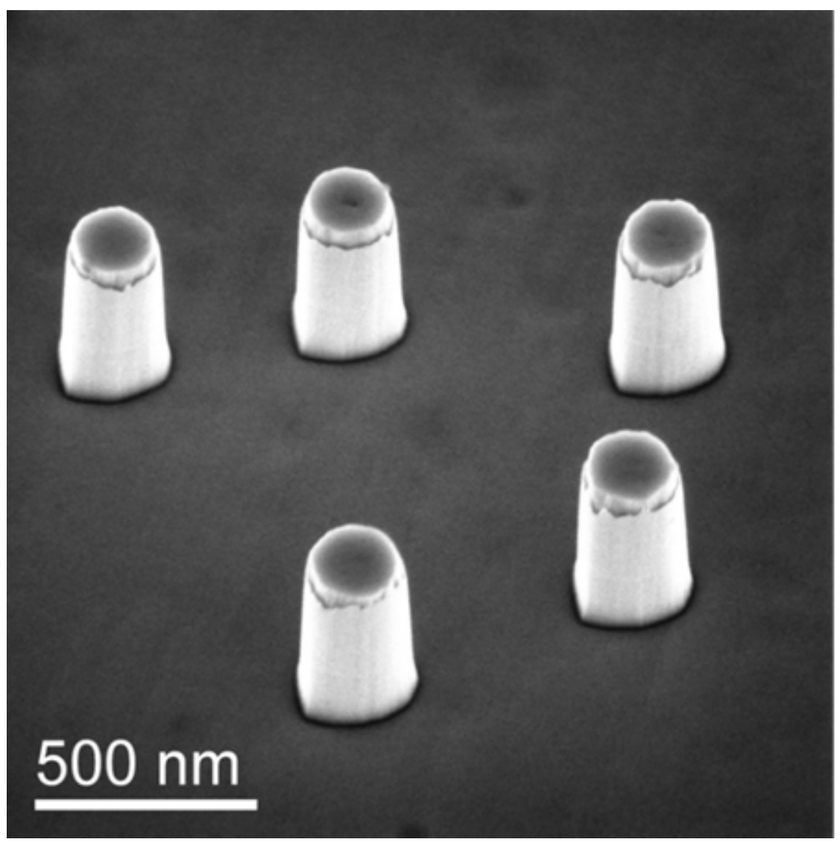
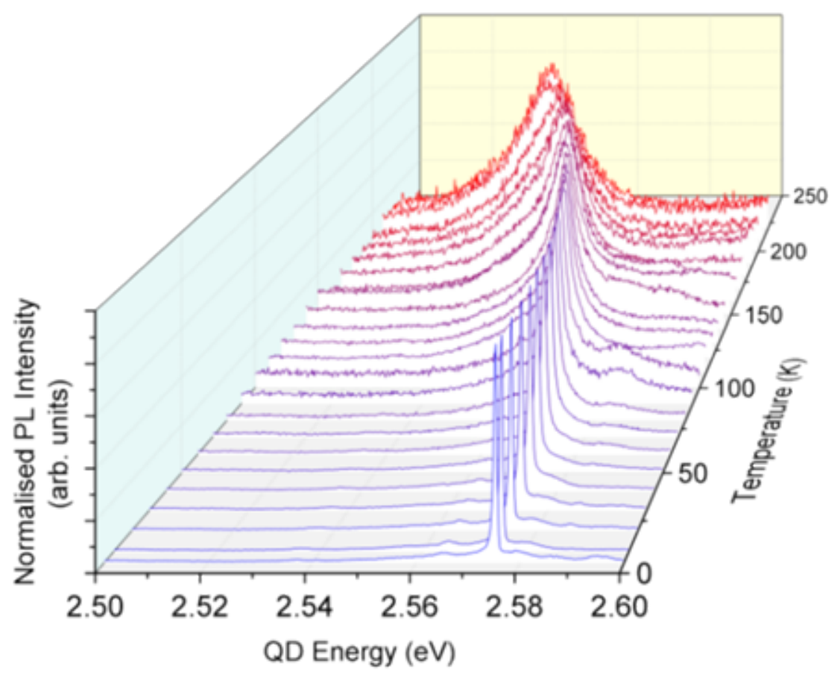
NANOSCIENCE COLLOQUIUM

Nitrides quantum dots for quantum light sources

by Rachel OLIVER
University of Cambridge

Abstract: A quantum light source is a device that can generate one single photon – or an entangled pair of photons - on demand. Whilst a single photon emitter would be pretty useless as a car headlight or bedside lamp, these devices are in increasing demand for new developments in optical communication which might exploit fundamental principles of quantum physics to achieve data security. Linear optical quantum computation, precision optical measurement and even random number generation also present potential applications opportunities for such light sources.
However, many of the most mature quantum light sources operate at temperatures only accessible using liquid helium, at best inconvenient and at worst prohibitive for applications. Exploiting nitride semiconductors allows device concepts developed in the more conventional arsenide semiconductor family to be applied, but whilst arsenide devices are limited to cryogenic temperatures, nitride devices can operate at temperatures accessible using on-chip, Peltier cooling, and in some cases even at room temperature.
Unfortunately, working with these less mature semiconductors has its pitfalls: high densities of defects and the impact of internal electric fields can limit device performance. For example, the wavelength of emission from nitride single photon emitters wanders with time, which is not compatible with applications which demand resonance of the emitter with a cavity or (more stringently) the emission of indistinguishable photons. Nitrides crystals grown in unusual orientations can overcome these challenges whilst maintaining good temperature stability, providing new opportunities for real-world quantum technologies.





Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

19.04.2022
1:15 pm | Zoom

CHyN
Center for Hybrid Nanostructures