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Fachbereich Physik, Universität Stuttgart
Max-Planck-Institut für Festkörperforschung
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Integrated quantum photonic devices with single quantum dot emitters

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Abstract

The integration of semiconductornanostructures with on-chip photonic devices offers the possibility to incorporate quantum-dot (QD) single-photon sources into advanced quantum-optical circuits. In order achieve this goal, a number of key photonic components have to be developed in a platform that is compatible with III-V quantum dots. In this presentation I will review progress at the University of Sheffield on integrating InGaAs quantum dots into GaAs photonic circuits. I will describe work demonstrating an on-chip Hanbury Brown-Twiss interferometer composed of an InGaAs QD coupled to a monolithic beam splitter, a resonantly-excited QD source emitting high coherence single photons into a single-mode waveguide with high efficiency, and an on-chip single-photon router. I will then discuss experiments investigating the coupling of the spin of single QD excitons to circularly-polarized photonic modes, focusing on very recent results demonstrating chiral emission from quantum dots embedded in nano-photonic waveguides. These results lay the foundations for more complex photonic integration, opening the route to multi-qubit circuits with advanced quantum-optical functionality.