## Contribution submission to the conference Bonn 2025

**Optical design and tolerance analysis of additively manufactured optical interfaces for spin qubits** — •Lucas Kirchbach and Andreas Stute — Technische Hochschule Nürnberg Georg Simon Ohm

Readout efficiency is crucial in all optical quantum technologies that employ single qubits or single quantum emitters. One of those systems is the nitrogen vacancy (NV-Center) in diamond, where total internal reflection at the diamond surface severely limits the photon yield. Recent efforts for enhancing the collection efficiency of single NV-Centers include shaping the diamond surface to a hemisphere or printing solid-immersion lenses (SIL) on top of it. In order to further improve the photon collection efficiency, we intend to additively manufacture polymer lenses on top of the crystal via multi-photon lithography. This works presents multiple optical designs based on 3D-printed polymer lenses and discusses their performance, robustness and scalability via simulation of their optical, thermal and mechanical properties. We also present a method to determe lens geometries based on a differential equation approach.

**Part:** Q
**Type:** Poster
**Topic:** 10.1 Nanooptik (Einzelne Quantenemitter); 10.1 Nano-Optics (Single Quantum Emitters)
**Keywords:** NV Center; Micro Lens; Lithography; Optical Design; Simulation
**Email:** lucas.kirchbach@th-nuernberg.de