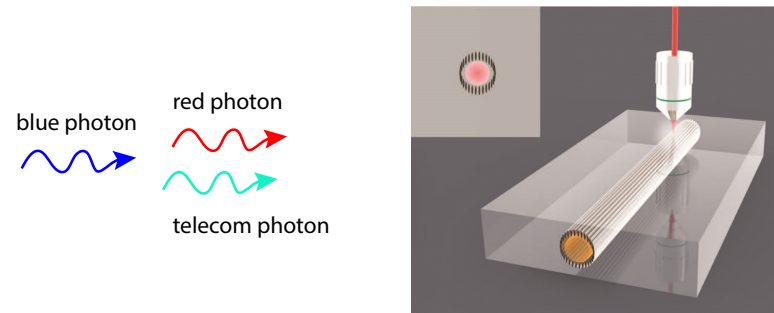


Master thesis project: Entangled photons for quantum networks from a lithium tantalate waveguide

Group Nonlinear Quantum Optics (by Dr. Sven Ramelow)
Contact: sven.ramelow@physik.hu-berlin.de

Entangled photons from optical nonlinear crystals [1] play an important role in fundamental tests of quantum mechanics [2] as well as for emerging quantum technologies like quantum key distribution (QKD) and quantum computing [3]. In this master thesis project a new type of bright photon pair source based on a laser-written waveguide [4] in periodically-poled lithium tantalate (ppSLT) is investigated. Photon pairs are generated via spontaneous parametric down-conversion (SPDC) of blue pump photons from a laser. The project will involve laser and optics alignment, photon detection with superconducting nanowire single-photon detectors, coincidence counting, investigation of the losses of the waveguide and its transverse optical mode structure, as well as basic simulations of the dispersion properties of the material and waveguide[5].



- [1] KWIAT, Paul G. ; MATTLE, Klaus ; WEINFURTER, Harald ; ZEILINGER, Anton ; SERGIENKO, Alexander V. ; SHIH, Yanhua: New high-intensity source of polarization-entangled photon pairs. In: *Physical Review Letters* 75 (1995), Nr. 24, S. 4337
- [2] SHADBOLT, Peter ; MATHEWS, Jonathan C. ; LAING, Anthony ; O'BRIEN, Jeremy L.: Testing foundations of quantum mechanics with photons. In: *Nature Physics* 10 (2014), Nr. 4, S. 278–286
- [3] KIMBLE, H J.: The quantum internet. In: *Nature* 453 (2008), Nr. 7198, S. 1023–1030
- [4] LI, Lingqi ; KONG, Weijin ; CHEN, Feng: Femtosecond laser-inscribed optical waveguides in dielectric crystals: a concise review and recent advances. In: *Advanced Photonics* 4 (2022), Nr. 2, S. 024002–024002
- [5] DOLEV, I ; GANANY-PADOWICZ, A ; GAYER, O ; ARIE, A ; MANGIN, J ; GADRET, Grégory: Linear and nonlinear optical properties of MgO: LiTaO 3. In: *Applied Physics B* 96 (2009), S. 423–432