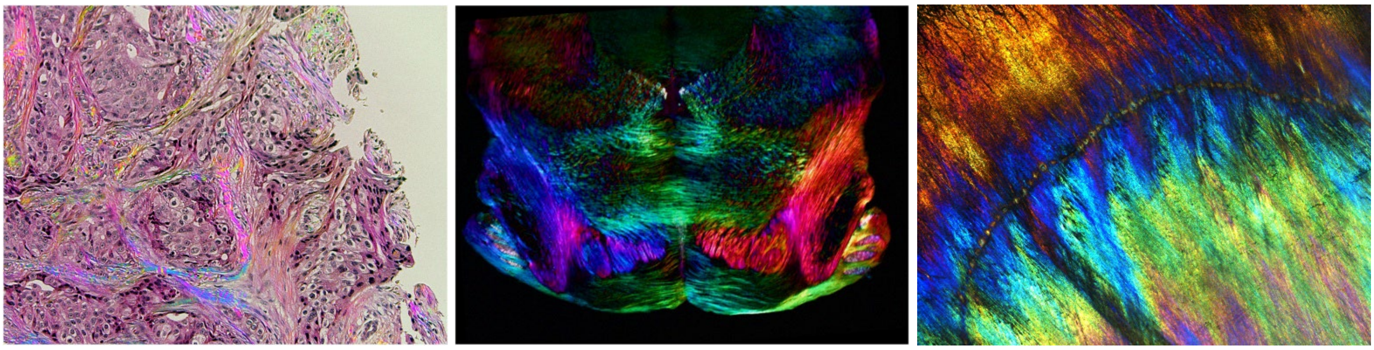
# Quantum polarimetry for biomedical and technical metrology

Polarization of light can serve both as an instrument and a subject under study in a wide range of fundamental and applied research areas. Understanding the polarization behavior of light sources and characterization of the polarization response of an object of interest allows investigation of the inner structure of the specimen (e.g., birefringence of crystals and bio-tissues, microstructures of artificial and natural origin), its chemical compositions (e.g., detection of chiral proteins, molecules, their assemblies), etc. The acquired knowledge is then applied for optical biomedical diagnostics, nonlinear optics, and for expanding quantum applications in the fields of communication, computing, and metrology. Within this project, we investigate the potential of quantum polarimetry and niches for its employment with the emphasis on:

– Realization of biomedical metrology via the well-acknowledged quantum state tomography as well as the recently introduced classification approach with polarization-entangled photon pairs,
– Demonstration of the quantum advantage of polarimetry with entangled photon pairs with respect to classical techniques,
– Fundamental studies of applicability of the quantum polarimetry for technical and biomedical metrology, especially for the influence of the entanglement degree, wavelength-degeneracy of the photon pairs, etc.

### Depending on the abilities and preferences of the candidate the activities within the described project might include:

– Design and performance of the experiments on real samples with the existing instrument,
– Upgrade of the existing instrument for extra measurement modalities,
– Characterization of the instrument and establishment of the approach to the level of metrological standards,
– Development and realization of auxiliary measurement setups.



(a) (b) (c)

*Birefringence in (a) collagen fibers in a stained breast cancer tissue [Sci. Rep. 5, 17340 (2015)], (b) a mouse brain slice [Sci. Rep. 5, 17340 (2015)]; (c) polarization-dependent reflection due to microstructures in the fish skin [PNAS 110 (24) 9764-9769 (2013)].*

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