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Nanophotonics with nanomembrane materials and architectures

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Nanomembranes are thin, flexible, transferable and can be assembled into 3D micro- and nanoarchitectures. In case optically active nanomembrane materials are selected many new research paths and exciting future application scenarios open up in nanophotonics. For instance, if semiconductor nanomembrane materials including high quality quantum emitters are transferred onto piezoelectric substrates, high speed and wavelength tunable entangled photon sources can be produced, which could lie at the heart of future quantum communication technologies.
If nanomembranes are differentially strained they deform themselves and roll-up into microtubular structures upon release from their mother substrate. Photonic rolled-up microtubes can be exploited as 3D microcavities to study spin orbit coupling of light or selective opto-plasmonic coupling in vertical ring resonators. Fully on-chip integrated systems offer interesting options for 3D photonic integration and lab-in-a-tube concepts.