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Single photon frequency conversion and channelization based on microwave piezo-optomechanical devices. LINRAN FAN, CHANGLIN ZOU, MENNO POOT, RISHENG CHENG, HONG TANG, Yale University — Cavity optomechanics holds very promising potentials for quantum information processing, as it provides both a convenient method to manipulate photons and a platform to bridge different quantum system. Especially, the integration of microwave devices with cavity optomechanics draws great interest as such a hybrid platform can provide strong electrical actuation, ultra-sensitive optical readout, and parametric mechanical signal amplification simultaneously in a single device. This hybrid platform enables great functionalities in manipulating photons, and builds direct link between microwave photon and optical photon, which is important for future quantum network. Aluminum nitride (AlN) is ideal for such hybrid platform. Besides low optical and mechanical loss, AlN possesses strong piezoelectric effect, which gives rise to strong coupling between microwave cavities and mechanical resonators. We will present our recent progress in developing integrated AlN hybrid platform for photon manipulation, such as optical amplification and absorption, cascaded optical delay, single photon frequency shifting, etc.

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