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Optomechanical down-conversion SIMON GROEBLACHER, SEBASTIAN HOFER, WITLEF WIECZOREK, MICHAEL VANNER, University of Vienna, Austria, KLEMENS HAMMERER, Leibniz University Hannover, Germany, MARKUS ASPELMEYER, University of Vienna, Austria — One of the central interactions in quantum optics is two-mode squeezing, also known as down-conversion. It has been used in a multitude of pioneering experiments to demonstrate nonclassical states of light and it is at the heart of generating quantum entanglement in optical fields. Here we demonstrate first experimental results towards the optomechanical analogue, in which an optical and a mechanical mode interact via a two-mode squeezing operation. In addition, we make use of the fact that large optomechanical coupling strengths provide access to an interaction regime beyond the rotating wave approximation. This allows for simultaneous cooling of the mechanical mode, which will eventually enable the preparation of pure initial mechanical states and is hence an important precondition to achieve the envisioned optomechanical entanglement.

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