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Entangled Mechanical Oscillators[1] JOHN D. JOST, NIST, Boulder, CO, J.P. HOME, J.M. AMINI, D. HANNEKE, R. OZERI*, C. LANGER**, J.J. BOLLINGER, D. LEIBFRIED, D.J. WINELAND — Quantum entanglement has been the subject of considerable research, in part due to its non-intuitive nature and ubiquitous presence in quantum information processing. For this reason, it is of interest to study entanglement in a variety of systems. We demonstrate deterministic entanglement in a system pervasive in nature: mechanical oscillators. Here, the mechanical oscillators are composed of the vibrations of two Be^+- Mg^+ ion pairs held in spatially separate locations. We also demonstrate the entanglement of the internal states of a Be^+ ion with a distant mechanical oscillator. The techniques demonstrated in this experiment are likely to form core components of large-scale trapped-ion quantum information processing. * Weizmann Institute of Science, Israel ** Lockheed Martin, Denver, CO

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