

**Prize Talk** PV V Tue 18:45 e415  
**Quantum information processing with macroscopic objects** —  
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Single atoms and atom-like particles have always been in the main-stream of quantum information processing and quantum technologies. However, as it has been realized for the first time about twenty years ago, collective quantum states of large many-body quantum systems can be generated and possess some unique properties and advantages. Examples of such systems span from collective spins of large atomic

ensembles to motional degrees of freedom of mechanical oscillators. In the talk I will review some of the experiments with macroscopic quantum systems performed at my group over the past two decades. Those include generation of entanglement, quantum teleportation and quantum memory with large atomic ensembles. In the field of quantum sensing and measurement an atomic spin ensemble in magnetic field can play the role of a negative mass reference frame in which simultaneous measurement of position and momentum become possible. Applications of this principle to sensing of magnetic fields, acceleration and even gravitational waves will be briefly discussed.